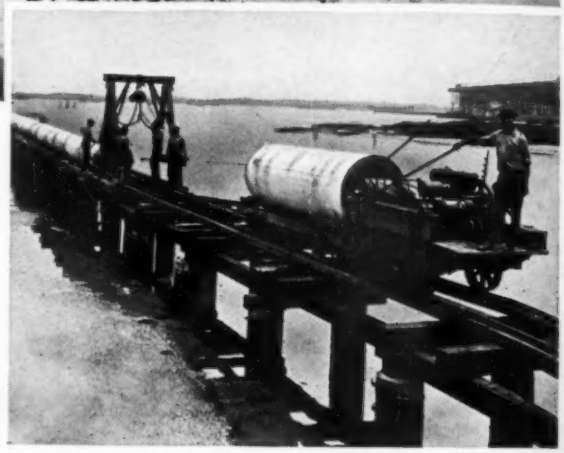
WATER & SEWAGE WORKS

WASTE TREATMENT PLANT OF TALON, INC.

LOCK JOINT REPEAT PERFORMANCES

1943 – Installing 36" pipe alongside of old wood stave pipeline which it replaces.

1921 – Installation of Lock Joint pressure pipeline on Trestle over Elizabeth River.



10 JOBS SINCE 1920

AS NORFOLK GROWS so must its water supply system. For more than 25 years municipal engineers have met this City's continually increasing need for water by installing 73 miles of Lock Joint Reinforced Concrete Pressure Pipe. Thus a water supply system of sustained high carrying capacity, negligible maintenance cost, immense structural strength and unfailing service is assured for generations.

Repeat orders from Norfolk and many other American cities are convincing evidence of the complete dependability, high quality and economy of Lock Joint Reinforced Concrete Pressure Pipe.

For future projects, large or small, specify Lock Joint Pipe.

A Hazen-Williams Hydraulic Slide Rule will gladly be sent upon request with our compliments.

★

SCOPE OF SERVICES

Lock Joint Pipe Company specializes in the manufacture and installation of Reinforced Concrete Pressure Pipe for Water Supply and Distribution mains in a wide range of diameters as well as Concrete Pipe of all types for Sanitary Sewers, Storm Drains, Culverts and Subaqueous lines.

LOCK JOINT PIPE COMPANY

Established 1905

P. O. Box 269, East Orange, N. J.

Pressure Pipe Plant – Wharton, N. J. **Sewer Plant – Kenilworth, N. J.**

BRANCH OFFICES: Denver, Colo. • Chicago, Ill. • Kansas City, Mo.
Rock Island, Ill. • Joplin, Mo. • Valley Park, Mo. • Cleveland, Ohio
Hartford, Conn. • Navarre, Ohio

WATER AND SEWAGE WORKS, "Reg. U. S. Pat. Off.," August, 1947. Volume 94. Number 8. Published monthly by Gillette Publishing Co., 22 West Maple St., Chicago 10, Ill. Per Copy, 25c. Subscription rate; United States, $2.00 per year; Canada, $2.00 per year; Foreign, $3.00 per year. Entered as Second Class Matter, March 12, 1946, at the Post Office at Chicago, Ill., under act of March 3, 1879.

A GREAT METER-MADE EVEN BETTER!

TYPE 2 PITTSBURGH with 5 Major Improvements

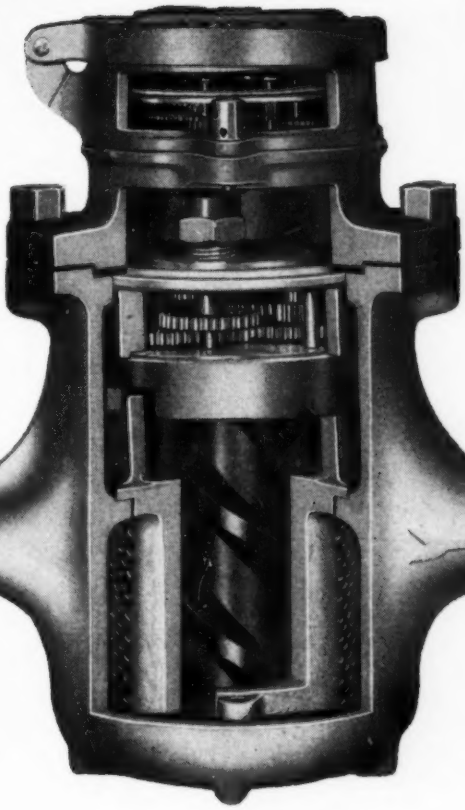
1 IMPROVED Larger measuring chamber for increased capacity.

2 IMPROVED Bigger diameter rotors for greater driving power, slower operating speed.

3 IMPROVED Heavier casting, larger body.

4 IMPROVED Precision cut rotors for satin-smooth operation.

5 IMPROVED Better materials and manufacturing techniques.



Cut-away view of ⅝ in. Type 2 Pittsburgh IMO meter

Here's welcome news for a great many water works men. The always silent, supremely accurate, durable and long-lived Pittsburgh IMO meter is again in production. And the Type 2 IMO is a greatly improved version of the original Type 1 model which, in itself, set new high performance standards for domestic meters. The war years presented the opportunity to reproportion component parts . . . to thoroughly test improved materials . . to completely re-tool for precision, volume output.

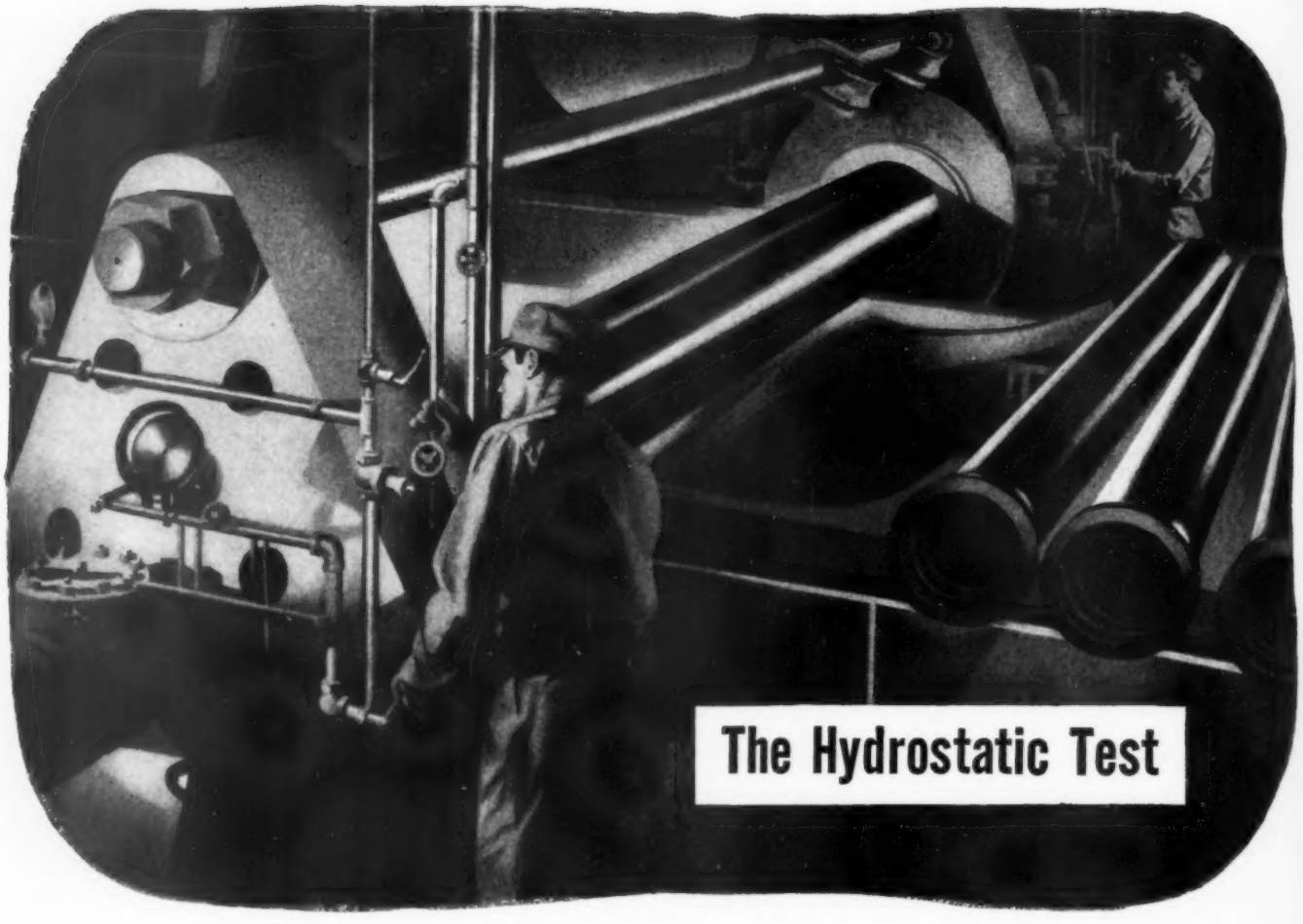
Without question, the Type 2 Pittsburgh IMO is the finest water meter ever produced. And in today's market it's the top value leader. There's no time like the present to look into the many advantages of this exclusive design. Ask our nearest district office for an eye-opening demonstration.

PITTSBURGH EQUITABLE METER DIVISION

Rockwell Manufacturing Company • Pittsburgh 8, Pa.

Atlanta Boston Chicago Houston Kansas City Los Angeles New York Pittsburgh San Francisco Seattle Tulsa

NOT FOR SALE UNLESS



YOU can't buy a length of cast iron pipe for love or money unless it has passed the Hydrostatic Test at the foundry. Every full length of cast iron pipe is subjected to this test under water pressures considerably higher than rated working pressures. It must pass the test or go to the scrap pile.

The Hydrostatic Test is the final one of a series of routine tests made by pipe manufacturers to ensure that the quality of the pipe meets or exceeds the requirements of standard specifications for cast iron pressure pipe.

Few pipe buyers realize the extent of the inspections, analyses and tests involved in the quality-control of cast iron pipe. Production controls start almost literally from the ground up with the inspection, analysis and checking of raw materials—continue with constant control of cupola operation and analysis of the melt—and end with inspections and a series of acceptance and routine tests of the finished product.

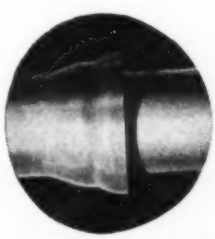
CAST IRON PIPE

IT MEETS THIS TEST

Members of the Cast Iron Pipe Research Association have established and attained scientific standards resulting in a product far superior to much of the cast iron pipe now in service underground. These standards, as well as the physical and metallurgical controls by which they are maintained, provide solid assurance that the cast iron pipe you lay today will live up to or exceed the long-life records of the oldtime product.

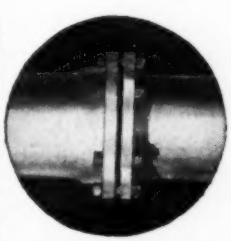
"Cast iron pipe not only offers a century or more of efficient life as a structure—it offers a century or more of efficient life as a carrier. In the limited areas with tuberculating waters, cement-lined cast iron pipe is tuberculation-proof and insures high carrying capacity for the life of the pipe. In the greatly predominating areas without tuberculating waters, the carrying capacity of unlined cast iron pipe remains practically unimpaired for the life of the pipe."

Joints for Cast Iron Pipe



Bell-and-Spigot Joint: the standard joint for water and sewerage service.

A variety of joints are available, of which the two most widely used are illustrated. Special purpose joints, such as the Ball-and-Socket, or Flexible Joint for underwater use, and the Flanged Joint for above-ground use, are also available.



Mechanical Joint: bottle-tight and flexible, now with interchangeable parts.

"SILENT SERVICE is not enough"—A.W.W.A.

The American Water Works Association is recommending to its members, for local action, a sound, well-planned program of Public Relations publicity and advertising. It is based on the premise that good water service, like good health, is too often taken for granted, in which case favorable public opinion is dormant.

To co-operate with this program and help to arouse national recognition of the efficient service rendered by America's water supply systems, the Cast Iron Pipe Research Association is presenting little known facts about public water supply to the *six million* readers of "Time" and "Nation's Business" throughout 1947.

For example, the following human-interest cartoon and excerpts from a current advertisement

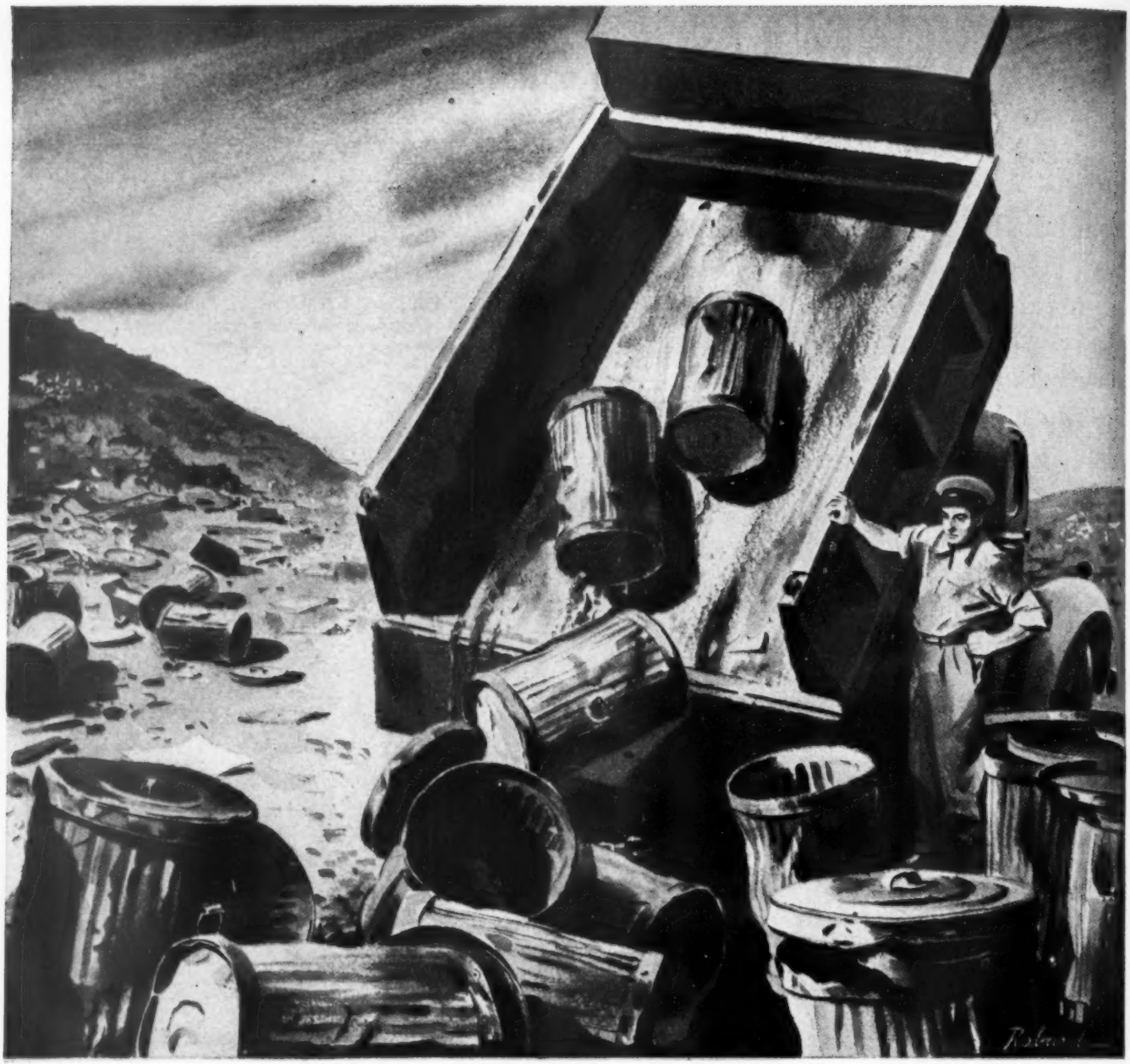
a lot for a little

Lowest-priced item in the family budget, but so indispensable it would be cheap at any price, is *water*. You can still buy your 300 gallons per day (average family consumption) for less than a dime. Yet operating costs of public water supply systems, like living costs, have gone skyward. The fact that there has been no general increase in water rates throughout the country, despite higher costs, is a tribute to the efficient and economical operation of America's water supply systems.

The low cost of water is the more remarkable when you consider that it is collected, stored, processed, distributed and made available at the turn of a faucet or a fire hydrant.

Cast Iron Pipe Research Association, Thos. F. Wolfe, Engineer, Peoples Gas Bldg., Chicago 3, Illinois.

SERVES FOR CENTURIES



What are they proving in Dearborn, Michigan?

Three hundred garbage cans . . . OUT!

Three hundred General Electric *Disposalls* . . . IN!

THAT'S THE up-to-the-minute picture in Dearborn, today—and it's a picture that's enlarging every day.

A small beginning, perhaps . . . but an important one. A promising one. It points to the day when "garbage" will be a forgotten word in this Midwestern community!

Even more vividly, it points to the vision and the foresight of Dearborn's public officials—men who recognized the healthful potential of a new, revolutionary garbage disposal method, and made its adoption possible.

For these men, it was more than simply giving the go-ahead signal for the home use of Disposalls. True, they were responsible for the future welfare of their community—but they were responsible for present economies, too.

First, they had to know the answers to important questions. Would the use of Disposalls cause sewage stoppages? Would they put an extra load on the treatment plant? Was this new method important enough to warrant the revision of a sanitary code?

Extensive laboratory testing for more than ten years provided many of the answers they were seeking. Actual

use in hundreds of communities gave them even more positive evidence of the efficiency of the Disposall method!

Today—along with more than 300 communities—Dearborn is proving the soundness of the method that represents the next great step in sanitation. A step that you, too, will want to follow—once you have studied the vital information listed below.

ANSWERING YOUR QUESTIONS ABOUT THE *DISPOSALL* METHOD OF ELIMINATING GARBAGE

1. "Why should food waste be instantly removed?"

Because, like human waste, food waste is organic matter—odorous and putrefactive. Attracting germ-spreading flies and rodents, it is a dangerous source of infection.

No less a threat to community health than was the outhouse, the garbage can should be as completely eliminated. The Disposall method can mean a garbage-free community!

2. "Has the Disposall method been adequately tested?"

Yes! Disposalls have been installed in more than 300 communities. Their efficiency in actual use, plus extensive laboratory testing for more than ten years, have proved Disposalls to be 100 per-cent efficient in the removal of food waste.

3. "Is there any danger of sewer stoppages?"

No! The Disposall shreds food wastes into such fine particles that they flow freely through the pipe lines without shoaling or settling.

Although similar to human wastes and other solids now flowing through your lines, Disposall processed food wastes are smaller, more water-buoyant and uniform in character. These wastes are ground in a controlled amount of cold water, which congeals and homogenizes greases into a form which will not clog sewer lines.

4. "Will I have to expand my plant's capacity?"

Not for many years will the number of Disposalls in a community become large enough to add appreciably to the loading on the normal treatment plant. Even if every home in your community used a Disposall, the *volume* of sewage flow would be increased by *less than two per cent.*

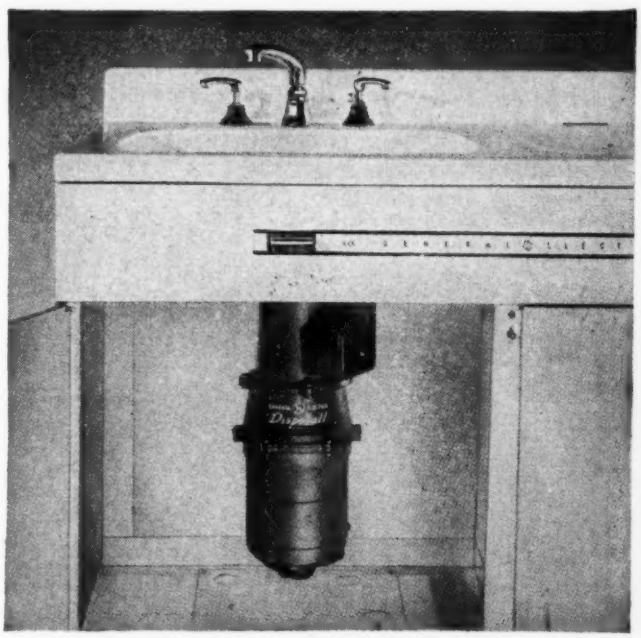
The addition of food wastes to the sewage flow will naturally increase solids and organic loading on the plant. But many plants will be able to handle this increased loading for some time; others can be expanded when necessary.

5. "Are sewage treatment plants necessary?"

Whether or not Disposalls are used, we believe that every community should have a sewage treatment plant. The Disposall method accentuates the need for these plants. They are needed! They provide a vital safeguard for public health!

6. "How can I get more information?"

Further information about Disposalls—and the Disposall method—is yours for the asking. We shall be glad to send complete information, to answer any specific questions you may want to ask. Please write to Department **WSW 847,** General Electric Company, Bridgeport 2, Connecticut.



The General Electric Disposall shown installed in our Electric Sink. Food waste is scraped into drain opening and safety cover placed in position. Cold water tap is then turned on, starting the Disposall operation. Food waste is shredded and flushed away automatically.

Disposall

TRADE-MARK REG. U. S. PAT. OFF.

CONVERTS FOOD WASTE TO SEWAGE—ELIMINATES "GARBAGE"

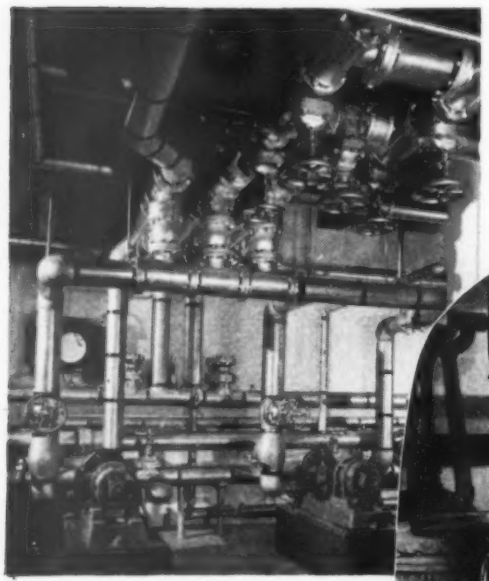
GENERAL ELECTRIC

valves may look alike ...But

. . . It's performance that counts! And Crane valves keep proving the truth of this axiom by year in and year out dependability in utilities service.

Since the beginning of modern flow control methods in waterworks and sewage plants, Crane valves and fittings have stood out in these important installations. Not because of appearance, but because of outstanding performance under all conditions. Today, Crane Quality is still your best value in piping equipment.

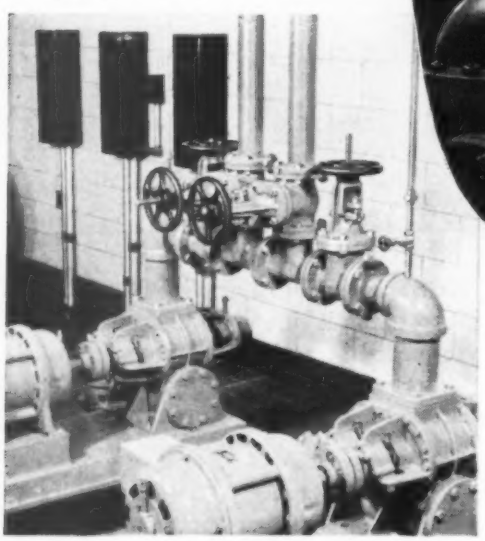
CRANE CO., *General Offices:* 836 S. Michigan Ave., Chicago 5, Illinois. *Nationwide Service Through Branches and Wholesalers.*



PUMP LINE PIPING *in sewage treatment plant with Crane standard iron body double disc gate valves. Plant serves about 25,000 population.*

PIPE GALLERY *in a village water works showing Crane iron double disc gate valves and fittings on main discharge lines to distribution system.*

PRIMING PUMPS *in a large metropolitan pumping station, equipped with Crane flanged and screwed piping materials.*



HIGH EFFICIENCY CONTROL FOR LOW PRESSURES . . . *in water works, filtration plants, sewage disposal systems, etc. Where service conditions do not require "standard" weight valves, Crane No. 793½ Low Pressure Iron Body Double Disc Gate Valves, with brass trim, will give excellent service at minimum cost. Crane quality design throughout; rated at 25 pounds steam, up to 50 pounds cold water. Sizes 10 in. and larger. See your Crane Catalog, pp. 122-123.*

EVERYTHING FROM . . .

CRANE

FOR EVERY PIPING SYSTEM

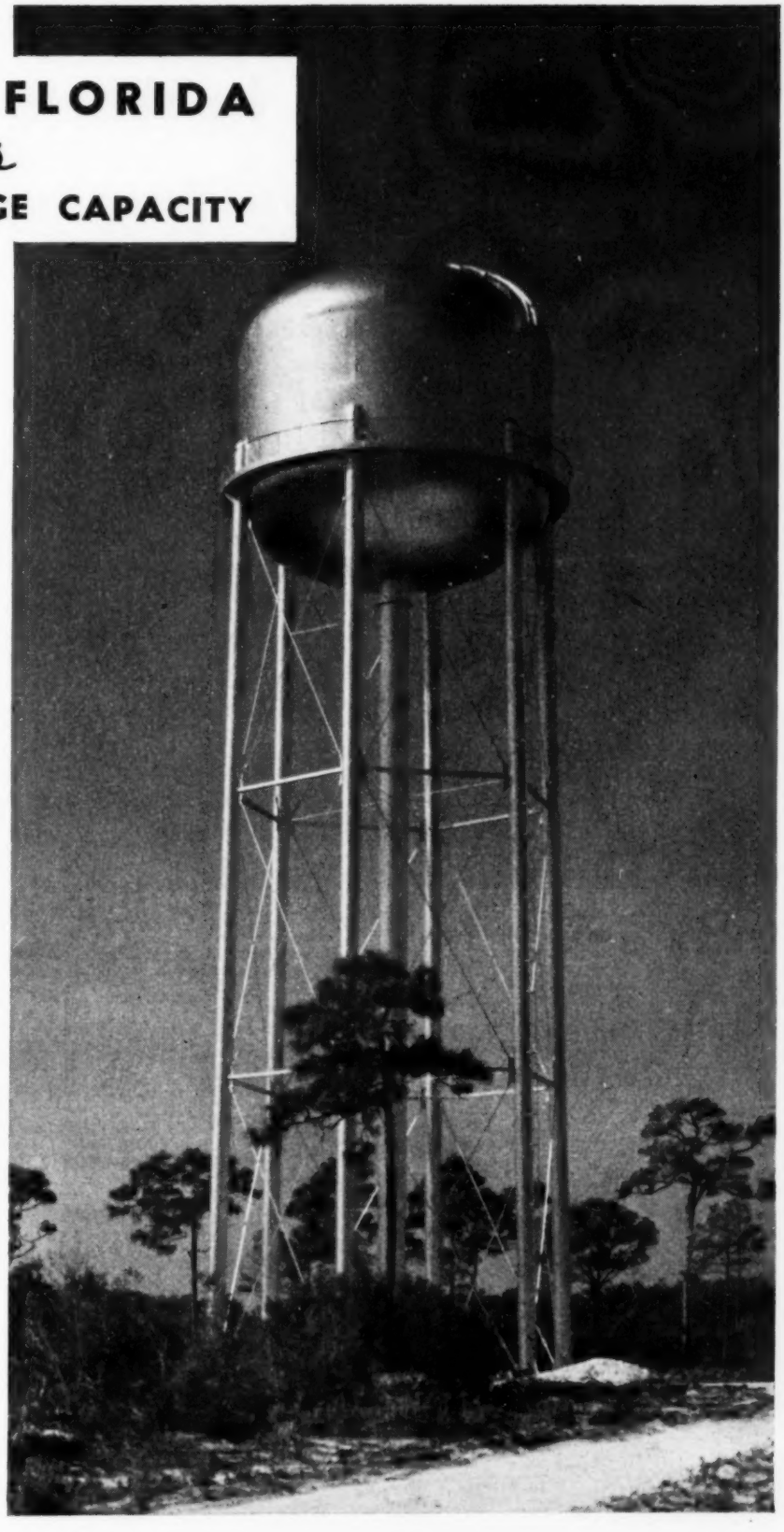
LAKE WORTH, FLORIDA
Increases
ITS ELEVATED STORAGE CAPACITY

We recently erected the 300,000-gal. Horton elevated tank shown at the right at Lake Worth to provide gravity pressure in the northern part of the water distribution system. This new tank increases the elevated storage capacity in the system and *opens the door* to reduced pressure variations and improved pressures throughout the entire city.

The city obtains its water from wells. The water system serves a population of approximately 12,000. Average daily consumption in 1940 and 1941 (when the population was somewhat less) was 1.74 mg. Prior to the installation of the new tank, the only elevated storage in the system was provided by a 300,000-gal. tank at the pumping station.

In addition to improving water pressure, elevated storage provides for pumping during off-peak periods. This often makes it possible to eliminate demand power changes, obtain lower power rates or, if there is a rate differential at night, pump a larger portion of the water at low rates. Elevated storage also means a more dependable supply of water for fire protection which usually lowers the insurance rating of a city.

Horton welded ellipsoidal-bottom elevated tanks have a relatively large diameter and shallow depth. This gives the structure pleasing proportions and also reduces the variation in pressure as water is drawn from the tank. The central riser is welded directly to the tank bottom. There is no expansion joint to require inspection or packing. When providing water storage for a municipal water distribution system, why not get the advantages of Horton *elevated* water tanks? Write our nearest office for quotations.



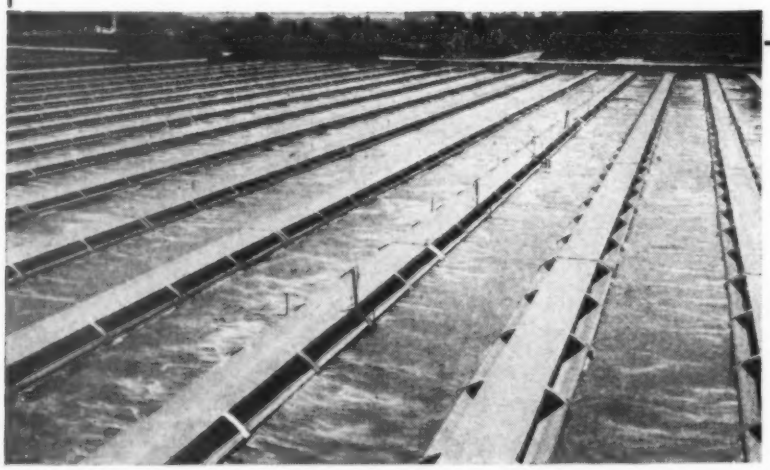
CHICAGO BRIDGE & IRON COMPANY

Chicago 4.....2198 McCormick Bldg.
New York 6.....3390-165 Broadway Bldg.
Cleveland 15.....2262 Guildhall Bldg.
Los Angeles 14.....1455 Wm. Fox Bldg.
Birmingham 1.....1586 North 50th St.
Atlanta 3.....2181 Healey Bldg.
Plants in Birmingham, Chicago and Greenville, Pa.

Tulsa 3.....1646 Hunt Bldg.
Houston 1.....5615 Clinton Dr.
Philadelphia 3.....1644-1700 Walnut Street Bldg.
Havana.....402 Abreu Bldg.
San Francisco 11.....1283-22 Battery Street Bldg.
Detroit 26.....1551 Lafayette Bldg.
In Canada: Horton Steel Works, Limited, Fort Erie, Ont.

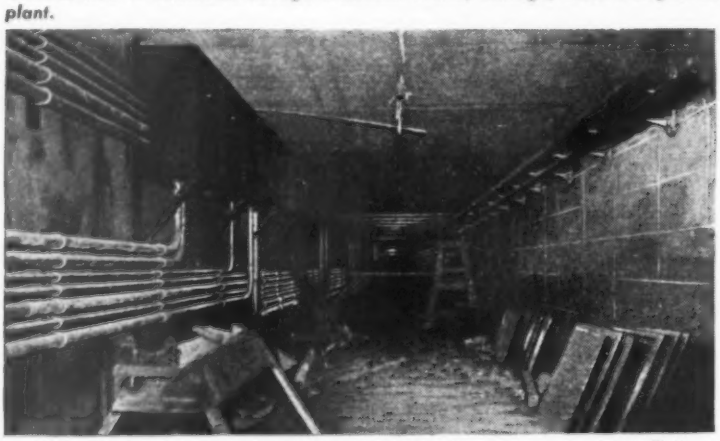
Performance in World's Largest Sewage Treatment Plant...

...leads to extended use of Everdur Electrical Conduit



Everdur Electrical Conduit serves the aeration and final settling tanks in bringing power from the operating galleries to the sluice gates at the control centers, and from these centers to the operating mechanism on the center pier of each tank.

General view of Southwest Sewage Treatment Works, Chicago, world's largest sewage plant.



Electrical tunnel, showing Everdur Electrical Conduit in course of installation. In all, 14 miles of such conduit were required.

WHEN Chicago's Southwest Sewage Treatment Plant was built ten years ago, a total of 14 miles of Everdur* Electrical Conduit, in sizes from ¾" to 2½", was installed . . . about 80,000 lb. of conduit and 20,000 lb. of fittings and boxes.

Conduit of Everdur Metal was selected because of its high physical properties and excellent resistance to many corroding agents. Today this Everdur Conduit is still giving excellent service where rustable conduit has failed. Additional Everdur Conduit is now being installed.

For detailed information on Everdur Copper-Silicon Alloys in Sewage and Water Works service, write for Publications E-11 and E-5. 46192-Rev.

*Reg. U. S. Pat. Off.

ANACONDA

Everdur

COPPER-SILICON ALLOYS

THE AMERICAN BRASS COMPANY

General Offices: Waterbury 88, Connecticut

Subsidiary of Anaconda Copper Mining Company

In Canada: ANACONDA AMERICAN BRASS LTD., *New Toronto, Ont.*

look what happened to "sparks"

Glance behind the miracle of wireless images flashed through space and you will see the hand of the pioneer in telegraphy. For video is an extension of the basic principles by which sound was first transmitted electrically. This expansion of pioneer conceptions into vast projects has created many modern industries. As a pioneer producer of electro-chemical products in America, Niagara has improved the quality of these materials and expanded the scope of their utility until they are now . . .
"An Essential Part of America's Great Chemical Enterprise."

NIAGARA ALKALI COMPANY

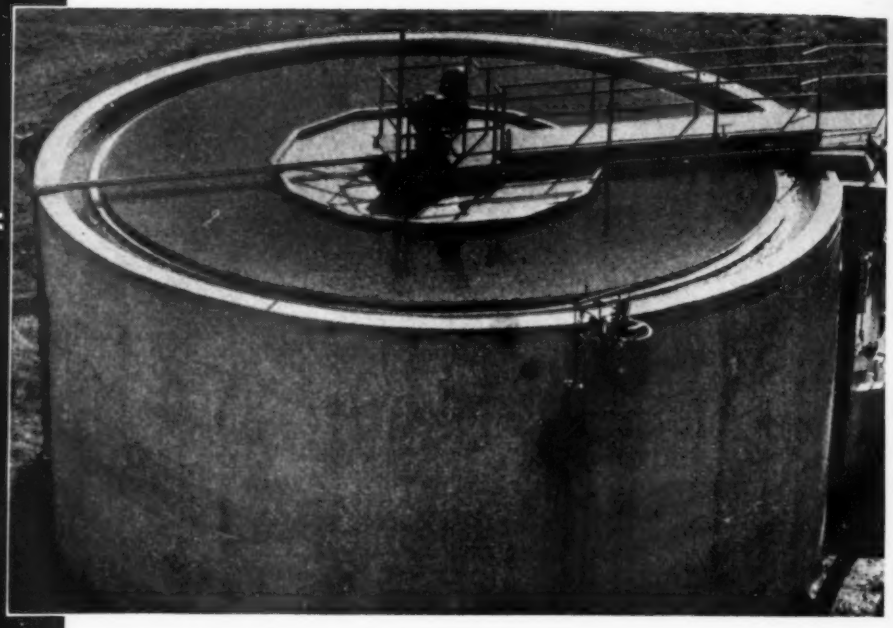
60 East 42nd Street, New York 17, N. Y.

LIQUID CHLORINE • CAUSTIC POTASH • CARBONATE OF POTASH • PARADICHLOROBENZENE • CAUSTIC SODA • NIAGATHAL (TETRACHLORO PHTHALIC ANHYDRIDE)

5 Extra Benefits in Water Treatment

ACCELATOR* *plus values*

1—Saves Space
2—Lower Cost
3—Simpler Operation
4—Faster Reaction
5—Higher Rates



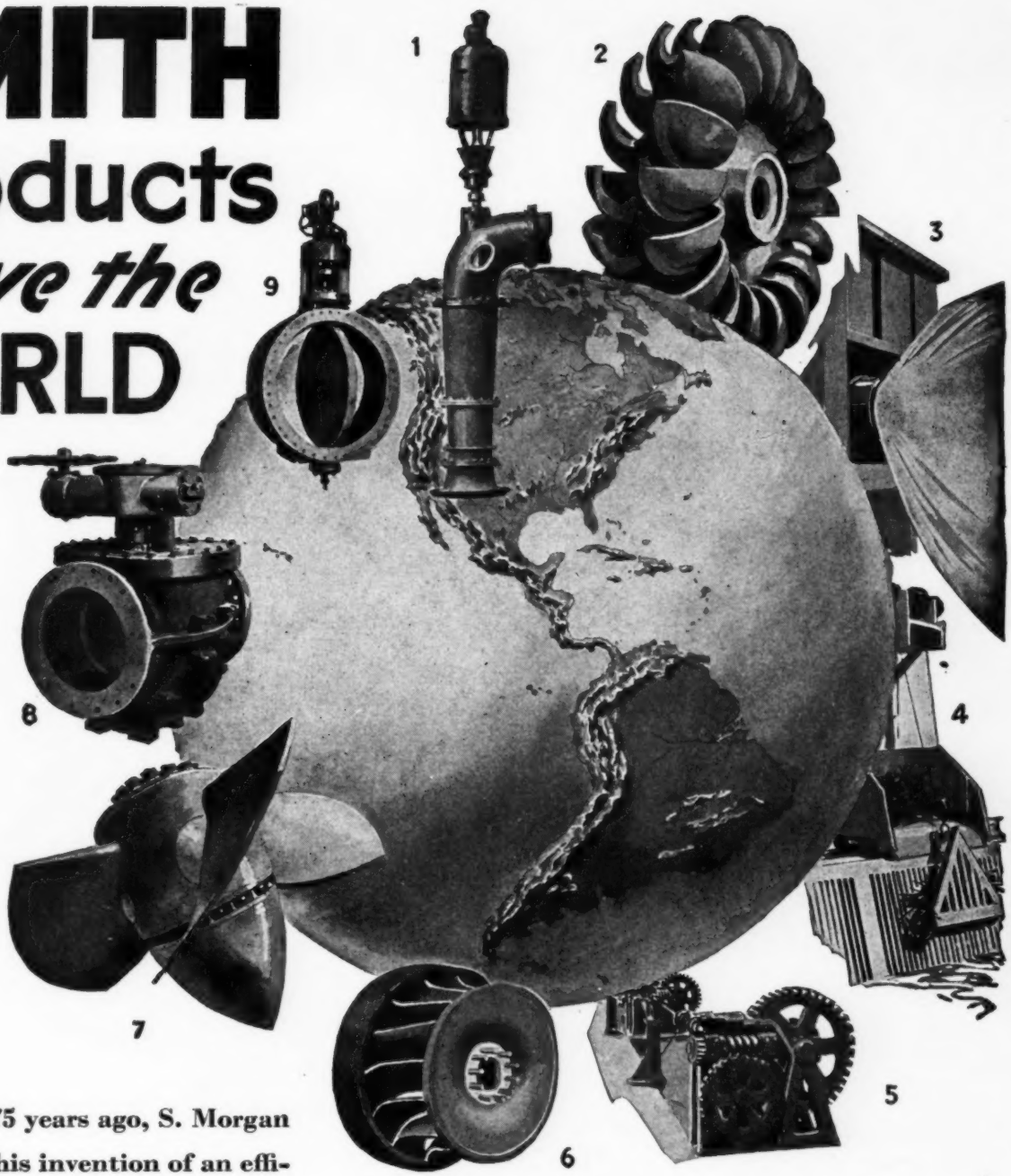
- **1. SAVES UP TO 80% IN SPACE** by combining in one unit the former separate steps of quick mixing, coagulating, settling and sludge removal.
- **2. LOWER CONSTRUCTION COSTS** result from the space-saving compact unit feature of the ACCELATOR. There is considerably less concrete structure.
- **3. SIMPLER OPERATION** is due to the automatic features of the ACCELATOR. It maintains at all times the optimum conditions for chemical treatment of water, provides for mixing, ample reaction time, effective clarification, and automatic sludge removal.
- **4. CHEMICAL REACTION IS FASTER,** because it takes place on the surface of old particles of an already well coagulated slurry with which the raw water and treating chemicals are intermingled.
- **5. HIGHER RATINGS,** because clarified treated water rises from the surface of the circulating slurry pool. There is no settling of solids—no percolating or filtering up through a suspended sludge blanket. Clear treated water separates from a dynamic flow of slurry.

*Trade-Mark Reg. U.S. Pat. Off.

IF YOU WANT TO KNOW — ASK INFILCO

Trade-Mark*

SMITH Products *Serve the* WORLD



NEARLY 75 years ago, S. Morgan Smith by his invention of an efficient water turbine helped to usher in an amazing Chapter in Human Progress. And those who followed have kept faith, as their engineering skill, research, financial stability, and manufacturing facilities conclusively prove!

Look at the array of products: 1-Axial Flow Pumps; 2-Impulse Turbines; 3-Howell-Bunger Valves; 4-Leonard Trash Rack Rakes; 5-Hoists; 6-Francis Turbines; 7-Smith-Kaplan Turbines; 8-Rotovalves; 9-Butterfly Valves. Write for data!

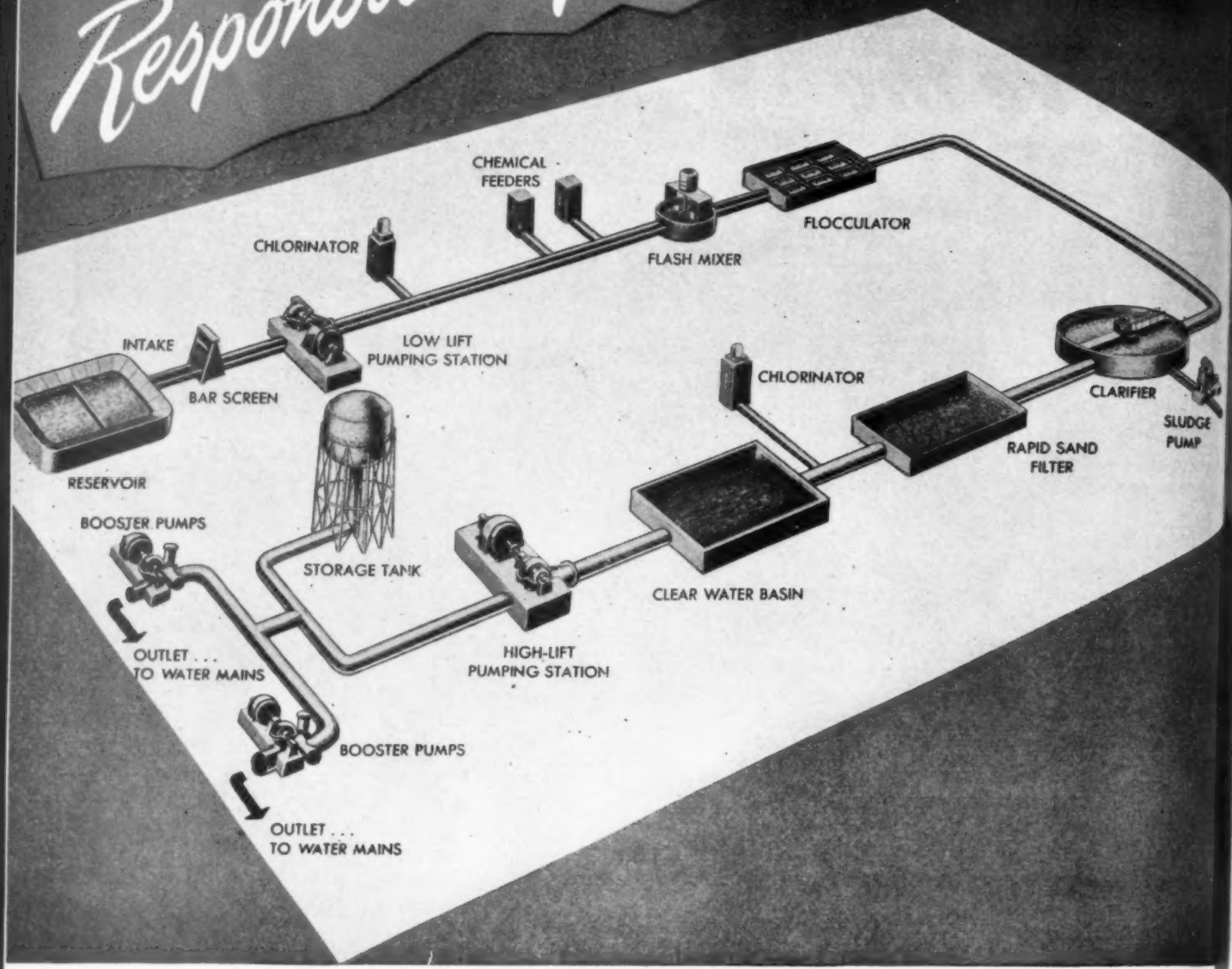
If It's Hydraulics~ Put It Up to Us!

S. MORGAN SMITH Co.

YORK, PENNA. U.S.A.

Unit Responsibility

KEY TO MORE



"A TO Z" SOLUTION TO YOUR ELECTRICAL OR POWER REQUIREMENTS . . . *FOR HIGHER OPERATING EFFICIENCY*

Whether your plans call for expansion, modernization or a completely new plant, you will find advantages in using the Westinghouse background in waterworks engineering—regardless of the size of the contemplated project.

Westinghouse engineers will work with you to obtain highest operating efficiency through the proper *selection, application* and *co-ordination* of the complete electrical drive.

Westinghouse equipment will provide you assurance of long-time, trouble-free service.

Westinghouse servicing will minimize and simplify your maintenance problems.

Typical of case histories where Westinghouse waterworks engineering has been job-proved is the City of Dallas 120 mgd Bachman plant, which is completely Westinghouse-electrified.

For help on your waterworks drive problem, call your Westinghouse office, or write today to Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-94746

OPERATING EFFICIENCY

"WESTINGHOUSE-EQUIPPED THROUGHOUT" MEANS SIMPLIFIED ORDERING, QUICKER INSTALLATION, MORE EFFICIENT OPERATION

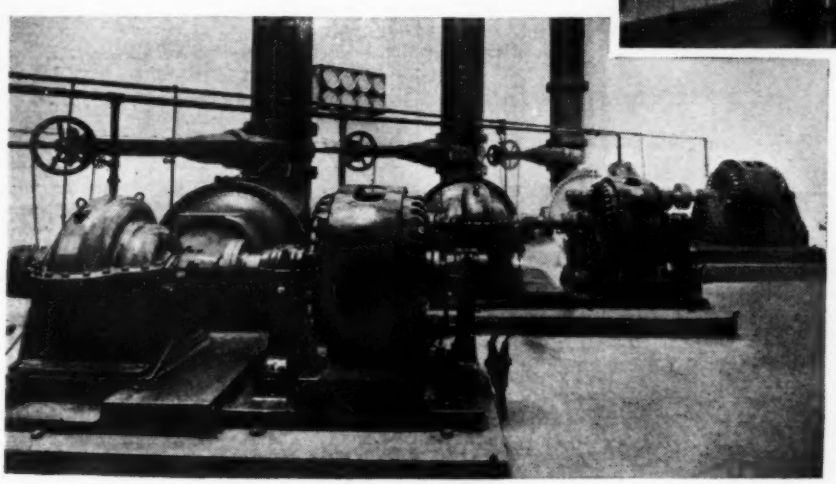
Putting power to work *efficiently* can be a major problem—or a simple one. When items must be selected, ordered and received from many sources, it means many chances for costly errors and delays . . . divided responsibility—or none at all—for performance of installed equipment.

Westinghouse offers the way to simplify the job. From equipment for generation of electrical or steam power, to the most specialized types of drives and control for its utilization, Westinghouse provides a single source of supply . . . one broad pair of shoulders competent to take responsibility for performance of all parts of the job.

Here is one of many examples where Westinghouse unit responsibility is preventing headaches . . . saving money . . . assuring *higher operating* efficiency:

MAIN PUMPING FLOOR of the 120 mgd Bachman Waterworks, City of Dallas, Texas. This plant has 15,225 hp in Westinghouse motors, supplemented by Westinghouse switchgear and other apparatus. The satisfactory service rendered is evidenced by 12 years' operation without repairs of any kind to electrical equipment, with a maintenance cost which has averaged less than 2c per hp.

In the center are five 800-hp and one 400-hp Westinghouse synchronous motors. At the left and right-rear two Westinghouse motor generator sets (one of which is a standby unit) furnish excitation for four 500-hp and three 900-hp Westinghouse motors located in the basement. At the right is shown part of the Westinghouse controls for the entire plant.

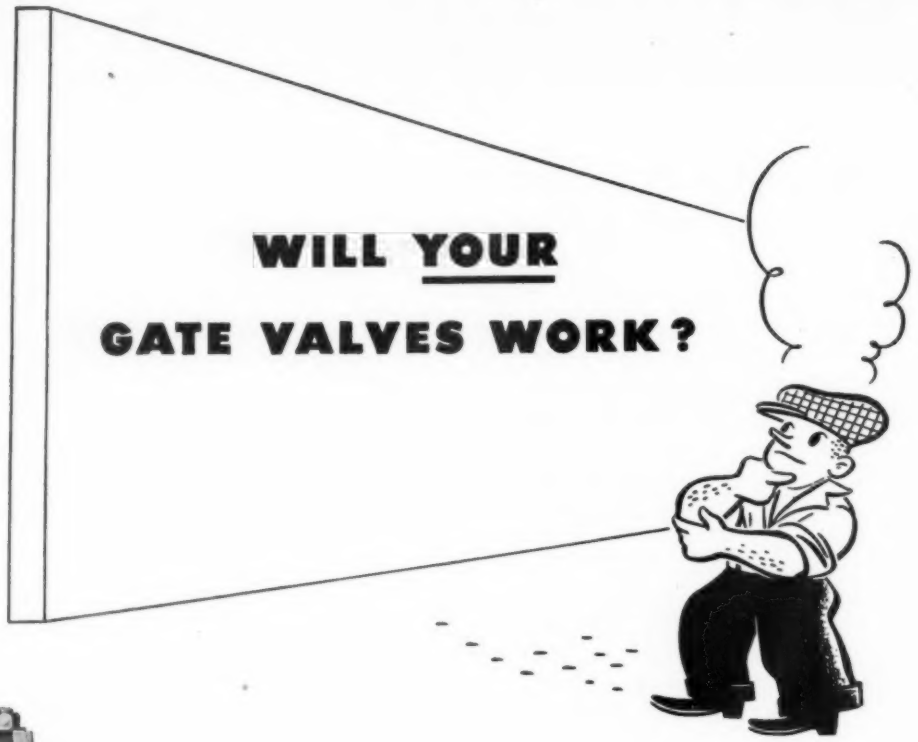


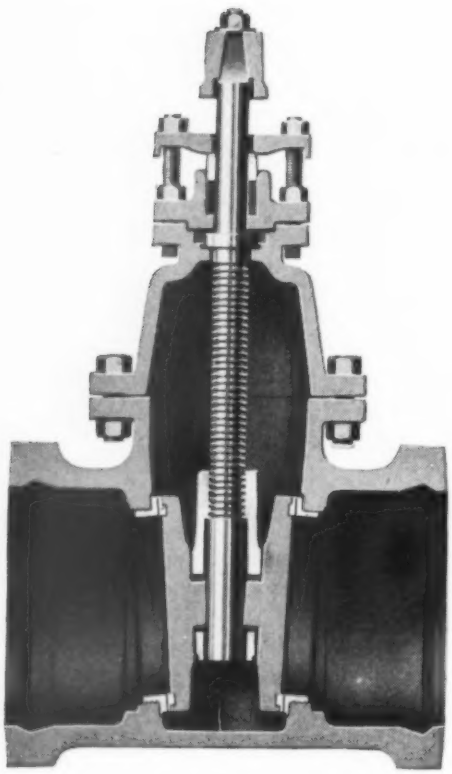
LEFT: Basement floor, showing three of four 500-hp Westinghouse motors, each of which drive a 30 mgd raw-water pump. Three 900-hp Westinghouse vertical motors, driving clear-water pumps, are also located on this floor but are not seen in this picture.

Westinghouse

PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE

MORE PRODUCTIVE POWER FOR INDUSTRY





High-strength cast iron. • Fully bronze-mounted. • Rigidly inspected, tested to 300 lbs. hydrostatic pressure. • Conforming to A. W. W. A. specifications. • Sizes from 2″ to 30″.

Deep buried in the earth, a gate valve must work when needed—or it is not worthy of the name. For there can come a time in the life of any community when public safety hinges on this mechanism alone.

The R. D. Wood Gate Valve has earned high confidence, having proved itself over a span of many years, and under conditions of every sort. It is so designed that practically nothing *can* go wrong. Just 3 internal parts—a spreader and two discs. No pockets to collect sediment. The discs move clear of the seats before being lifted into the bonnet, permitting unobstructed flow. Turning freely on the trunnions, they are not liable to wear at any *one* place—wear is distributed, life prolonged. In closing, the spreader action is *at the center* of the discs, seating them tight and even, and preventing leakage.

One of the fine compliments paid this gate valve is the fact that waterworks engineers often *specify* it—as an extra margin of safety. Give your community the *plus* protection of R. D. Wood Gate Valves.

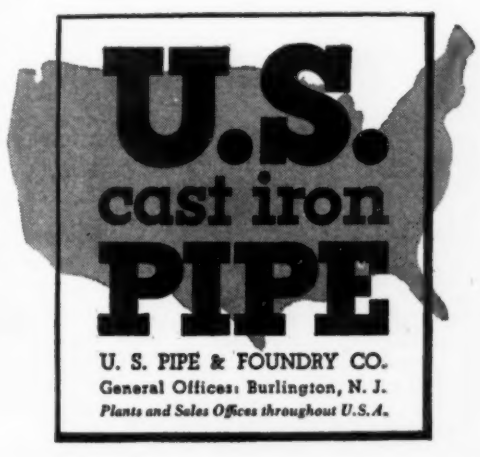
R. D. WOOD COMPANY

Public Ledger Building, Independence Square, Philadelphia 5, Pa.

Manufacturers of Mathews Hydrants and "Sand-Spun" Pipe (Centrifugally Cast in Sand Molds)

Original Woodcut by Lynd Ward

The life of a supply line, to be constructed with cast iron pipe, is obviously more predictable than the future growth of the community it is to serve. City planners may hazard a prediction of population growth in a hundred years. Water works engineers can predict, on the basis of proved service records, that a properly constructed cast iron supply line will have a useful life of *more* than a century. A substantial part of the tonnage of large diameter cast iron pipe, installed for supply lines throughout America, is U. S. Cast Iron Pipe.

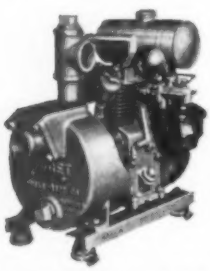


SEPTIC TANK CLEANING

Quick – Easy – Profitable

"HANDY" PUMP

A tiny pump weighing only 20 lbs., remarkable for performance. Fitted with pipe or common garden hose, this pump will lift up to 25 ft. Delivers 8 GPM at 40 lbs. pressure. Electric motor driven – self-priming. An extremely handy, dependable and trouble-free pump for all kinds of pumping jobs.



"MIDGET" PUMP

The ideal, lightweight, self-priming pump. Easily handled – weighs only 60 lbs. Will pump 3000 GPH at 20 ft. head, 5 ft. suction lift. Rapid automatic priming. Husky – trouble free – non-clogging. Whatever your pumping requirements may be up to 125,000 GPH there is a Gorman-Rupp Blue pump to do the job quicker and better.

WITH AN O.S.C. ON THE JOB

The New Odorless Sanitary Cleaner makes the Sanitary Service Operator's job an easy, pleasant and profitable one. Compare the following performance with that of old fashioned, disagreeable and unsanitary methods:

Septic Tanks of 500 gal. size cleaned in 15 minutes; 1000 gal. size in 20 minutes. A 25,000 gal. septic tank was actually cleaned in just 10 hours. Efficient? Yes, but also odorless and sanitary. No open tanks, diaphragm hand pumps, shovels or makeshift equipment. Approved by public health officials.

The O. S. C. is a modern apparatus especially engineered for cleaning septic tanks, vaults and cisterns. It can also be used for emergency fire fighting, sprinkling or dewatering flooded basements. It is equipped with a powerful Gorman-Rupp Centrifugal sewage pump of self-priming design and is shipped ready to mount on standard truck chassis of 158 to 161 inches.

Write for special bulletin 7-ST-11

THE GORMAN-RUPP COMPANY

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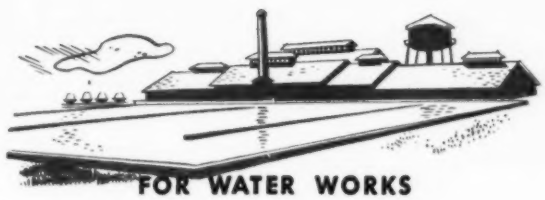
GENERAL CHEMICAL "ALUM"

...Equally Efficient for Coagulation of WATER and SEWAGE!



FOR WATER WORKS

1. Produces crystal clear water.
2. Gives better floc formation.
3. Promotes better settling and longer filter runs.
4. Aids in reduction of tastes and odors.
5. Has no chlorine demand.
6. Is a *low cost* coagulant.
7. Superior in tests against other coagulants.
8. High in quality. Its constant uniformity can be depended upon.

FOR SEWAGE PLANTS

1. Clean, easy to handle.
2. Dry feeds well or dissolves readily for solution feeding.
3. Simple application. Requires only low cost feeding apparatus and minimum attention.
4. Clear, colorless effluents are possible.
5. Sludge digests readily.
6. Treated digested sludge dries quickly with minimum of odor.
7. Chlorine consumption is cut due to lower demand of clarified sewage.
8. Economical to use.

Aluminum Sulfate is almost universally accepted by water experts as the best coagulant for removal of turbidity, color and bacteria from water . . . and General Chemical Aluminum Sulfate is the outstanding choice the nation over. That's because its high quality and constant uniformity have given it a time-tested reputation for reliability among operating men in towns and cities all over America.

Municipal officials in charge of sewage treatment also find that clarity of sewage effluent is easily obtainable with General Chemical Aluminum Sulfate for the many reasons outlined above. For your water and sewage disposal systems, specify General Chemical "Alum"—*preferred by most American cities.*

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GENERAL CHEMICAL COMPANY

FOR AMERICAN INDUSTRY

LOWERING 5-TON SECTION. Pipe was made to meet ASTM-C 75-41 specifications for 3000-lb. concrete.

LAID IN OPEN CUT. Most of line was laid in open cut 20 to 30 feet deep, on 6-in. concrete cradle.

84 in. CONCRETE PIPE

in 5-ton sections assures permanence of new Normal, Ill., relief sewer

EVERY time the town branch of Sugar Creek went on a spring rampage, Normal, Illinois, used to have a flood. Businessmen grew tired of having their basements full of Sugar Creek. Something has been done about it. Normal now has a relief sewer seven feet in diameter—big enough to take the overflow from one branch of Sugar Creek and ease it across town, away from the business district, to another branch of Sugar Creek where the surplus water can do no harm.

J. J. Woltmann, Consulting Engineer of Bloomington, Ill., designed the new 3500-foot Cypress Alley Sewer. He specified 84-in. CONCRETE PIPE—for strength to resist impact and sustain heavy burdens—for maximum hydraulic capacity—for minimum leakage and infiltration. Most of the line was laid in an open cut at depths of 20 to 30 feet, and the pipe rests on a 6-in. cast-in-place concrete cradle. Cassidy Construction Company of Melrose Park, Ill., handled construction.

PORTLAND CEMENT ASSOCIATION

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Pittsburgh-Des Moines

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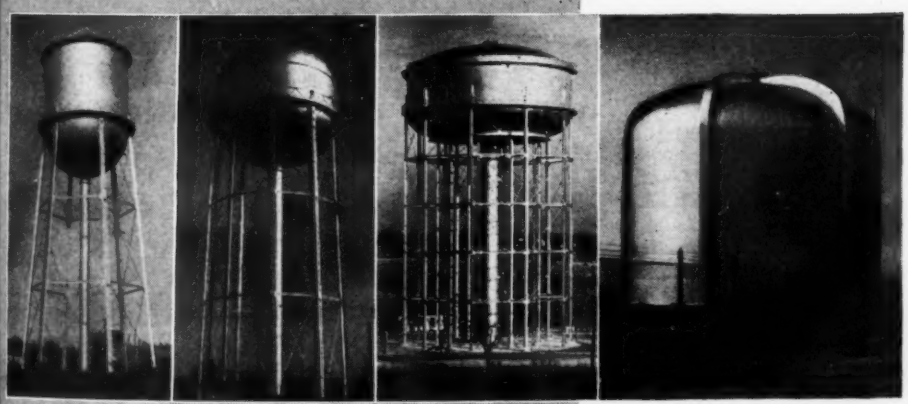
and STEEL RESERVOIRS

1,500,000 gal. toroidal bottom tank; structural tower. Diameter 103'4", head range 25'; height to bottom 85'. Fort Dodge, Iowa.

Two 3,000,000 gal. steel reservoirs, diameter 144', height 25'. Berryville, Va.



300,000 gal. cone roof, hemispherical bottom tank, 118' to top. Stillwater, Okla.

500,000 gal. double ellipsoidal tank, on 100' tower. Mission, Texas.

1,000,000 gal. toroidal bottom tank; diameter 76'9", height 127', head range 30'. Keokuk, Iowa.

2,200,000 gal. steel reservoir; ellipsoidal roof; ornamental pilasters. Diameter 80', height 51'. Midland, Tex.

The choice of elevated steel tank or steel reservoir depends largely upon local land elevations. The choice of PITTSBURGH-DES MOINES as designers, fabricators and erectors of your required units is equally logical: you benefit by a half-century of experience in this type of construction, and a guarantee of complete satisfaction with each installation. *May we consult on your water storage needs?*

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VERTICAL TURBINE PUMPS
WATER-LUBRICATED:
OPEN IMPELLERS.
OIL LUBRICATED:
CLOSED IMPELLERS.
You can take your choice at the "BIG STORE"...
The "Big Store" is an American institution, where a man can get a better buy from a broader choice. That's why most buyers go to a Fairbanks-Morse-Pomona dealer for their vertical turbine pumps.
They know that these dealers are not restricted in their recommendations. They know that they'll get impartial help in buying the right pump.
For instance, Fairbanks-Morse offers a choice of oil or water lubrication, open or closed impellers. This is greater surety of getting skilled, unrestricted service in obtaining the pump that is most suited to your particular pumping work.
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7 ways

to cut Sewage Disposal Costs with TRANSITE SEWER PIPE

IF YOU ARE SEEKING WAYS to lower sewage disposal costs, you will be interested in the opportunities for savings offered through the use of Transite* Sewer Pipe. Check these 7 important economies, all of them possible with Transite:

1. Lower excavation costs. Transite's low-friction coefficient (n=.010) provides greater flow capacity. This frequently permits flatter grades and shallower trenches with correspondingly lower excavation costs.

2. Lower handling costs. Long 13-foot lengths and light weight mean greater footage per truckload . . . less time required for unloading and lowering the pipe into the trench.

3. Lower pipe laying costs. Four classes of pipe, to meet a wide range of strength requirements for all loading conditions, minimize the need for costly concrete cradles. And Transite's long lengths mean fewer joints to assemble . . . less time for laying to line and grade.

4. Use of smaller diameter pipe. Transite's tight sleeve type joints are an effective safeguard against infiltration. Thus the total sewage load is reduced, which, coupled with Transite's higher flow capacity, makes possible the use of a smaller diameter pipe.

5. Minimum maintenance. Made of asbestos and cement combined by a special process, Transite Sewer Pipe is highly corrosion-resistant. Its tight joints safeguard against root trouble. And every length is factory-tested for strength and uniformity.

6. Reduced treatment costs. By cutting down on infiltration and reducing plant load, Transite helps reduce operating costs and conserve plant capacity for increased loads incident to future community growth.

7. Smaller treatment plants. Because Transite Sewer Pipe minimizes infiltration, plant capacity is more efficiently used. Where new plants are being designed, substantial savings in initial cost of construction and equipment may often be effected.

*Reg. U. S. Pat. Off.

For further information, write for Brochure TR-21A. Johns-Manville, Box 290, New York 16, N.Y.

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Working Pres. OK Test Pres. OK
Tested By 519 Inspected By 726
This equipment has been fully tested and inspected in accordance with standard practice for service recommended. Upon installation and field test, any defect should be reported at once. See reverse side of this tag.
THE VAPOR RECOVERY SYSTEMS COMPANY
COMPTON, CALIFORNIA
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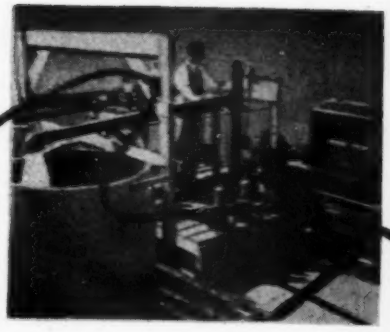

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RIGID TESTS OF

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✓"VAREC" SAFETY DEVICES

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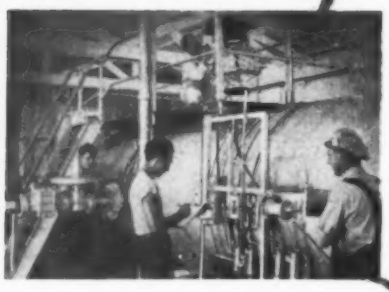
Flow charts and other valuable engineering data are available to you in the "VAREC" Catalog S-3. Write for a copy on your business letterhead today.



FLOW CAPACITY TESTING

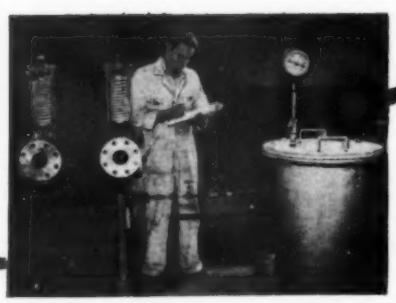
AIR PRESSURE TEST UNDER WATER

THE VAPOR RECOVERY SYSTEMS COMPANY

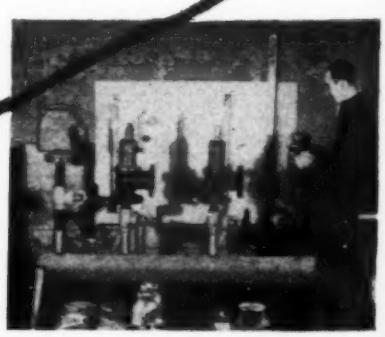
COMPTON, CALIFORNIA, U. S. A.

New York City — Chicago, Ill. — Cleveland, O. — Houston, Tex.
Agencies Everywhere—Cable Address "VAREC COMPTON" All Codes.

TESTING FOR "SET" PRESSURE AND "BLOW-DOWN"

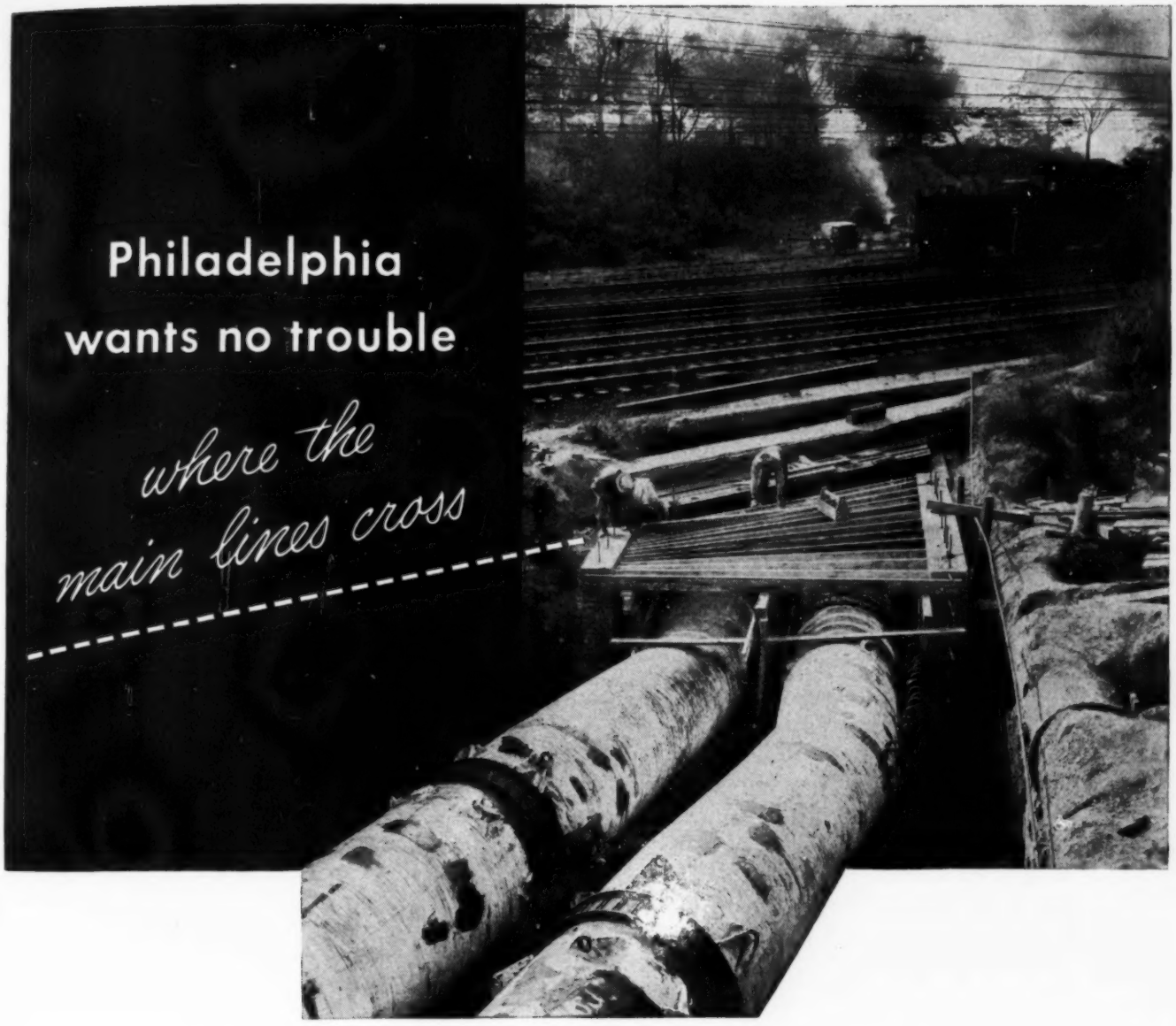


INTERNAL AND EXTERNAL HYDROSTATIC TESTING



CHECK TESTING FOR "SET" PRESSURE AND "VALVE TIGHTNESS"

"VAREC" — THE PACE SETTER SINCE 1928



Let the trains roll—Dresser *flexible* Style 38 Couplings are on the job to provide tight, yet vibration-proof joints for two of Philadelphia's vital water supply lines.

Rugged, leakproof joints were required on these 60-inch mains to absorb the pounding of the Pennsylvania Railroad's New York-Philadelphia-Washington traffic—the most heavily traveled railroad section in the country.

The same features which recommend Dressers for this installation—flexibility, to absorb harmful pipe stresses—permanent tightness—simplicity—are essential in all of the 15,000 feet of new water supply mains Philadelphia is coupling with Dressers. It stands to reason—a joint that will stay tight in a spot such as you see here is going to give trouble-free service on any water line.

Even in such cramped spaces—a couple of men with wrenches can easily make up these simple, factory-built and inspected joints.

In a nutshell, these are some of the reasons waterworks engineers everywhere rely on Dresser Couplings. Write today—Find out how *you* can save with Dressers.

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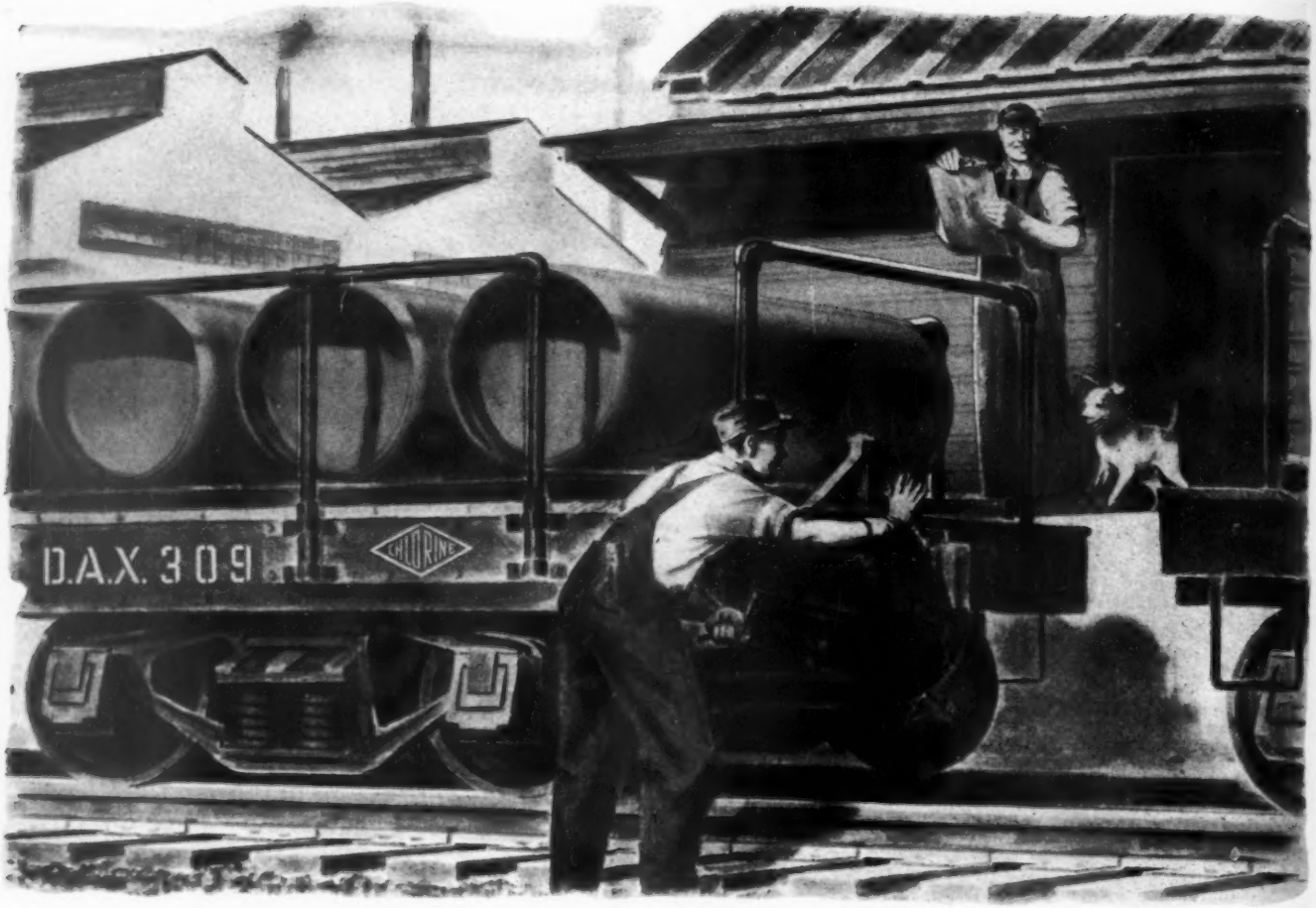

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Supplied in multi-unit cars,

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PITTSBURGH 22, PA., *and Everywhere*

DE LAVAL
Compressors for Sewage Plant Service

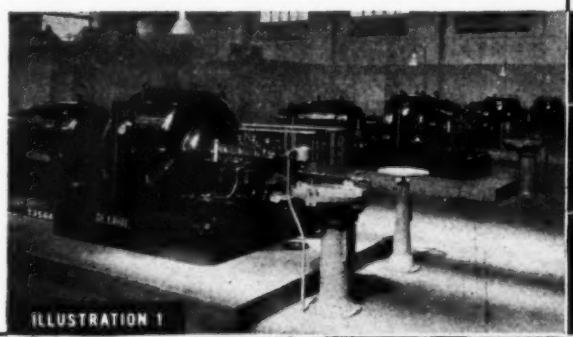
ILLUSTRATION 1

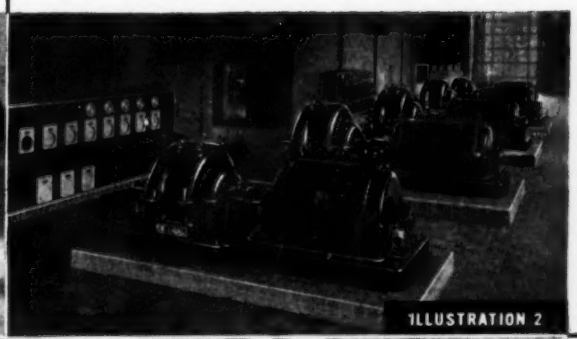
ILLUSTRATION 2

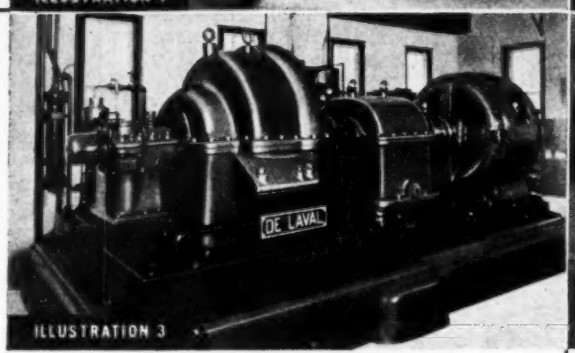

ILLUSTRATION 3

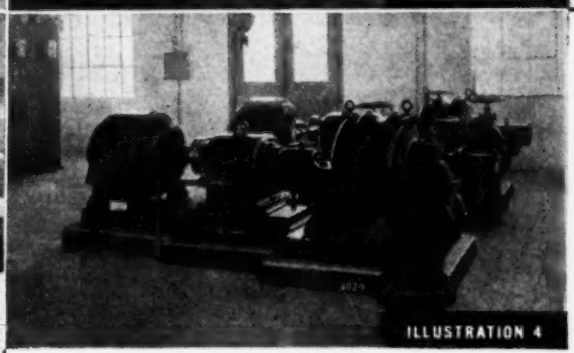
ILLUSTRATION 4

1. FOUR DE LAVAL COMPRESSORS OF 10,000 CFM CAPACITY AT 7 PSI installed at the Bowery Bay Sewage Treatment Plant, New York, N. Y.

2. DE LAVAL COMPRESSORS AT CLEVELAND. Two are rated at 40,000 cfm against 7.4 lb. gage at 3560 rpm and two at 25,000 cfm.

3. TWO-STAGE COMPRESSOR in activated sludge disposal plant at Houston, Texas. This unit has been in service for more than 19 years, operating 99% of the time.

4. TWO DE LAVAL GEARED TURBINE COMPRESSORS supplying 3000 cfm each at 8 psi for sewage aeration.

May we give you the benefit of our experience in figuring your compressor requirements?

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Detroit • Edmonton • Helena • Houston • Kansas City • Los Angeles
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BUILDERS PROVIDENCE
Instruments

5 REASONS WHY ALOXITE Diffusers Provide More Effective Sewage Aeration

Better results in various phases of primary and secondary sewage treatments follow installation of ALOXITE aluminum oxide porous plates and tubes. Here is the explanation:

1	UNIFORMITY OF STRUCTURE	● Assures uniform supply of small bubbles ● Increases oxygen absorption ● Provides more efficient treatment
2	RUGGEDNESS	● Permits repeated handling ● Cuts replacement costs
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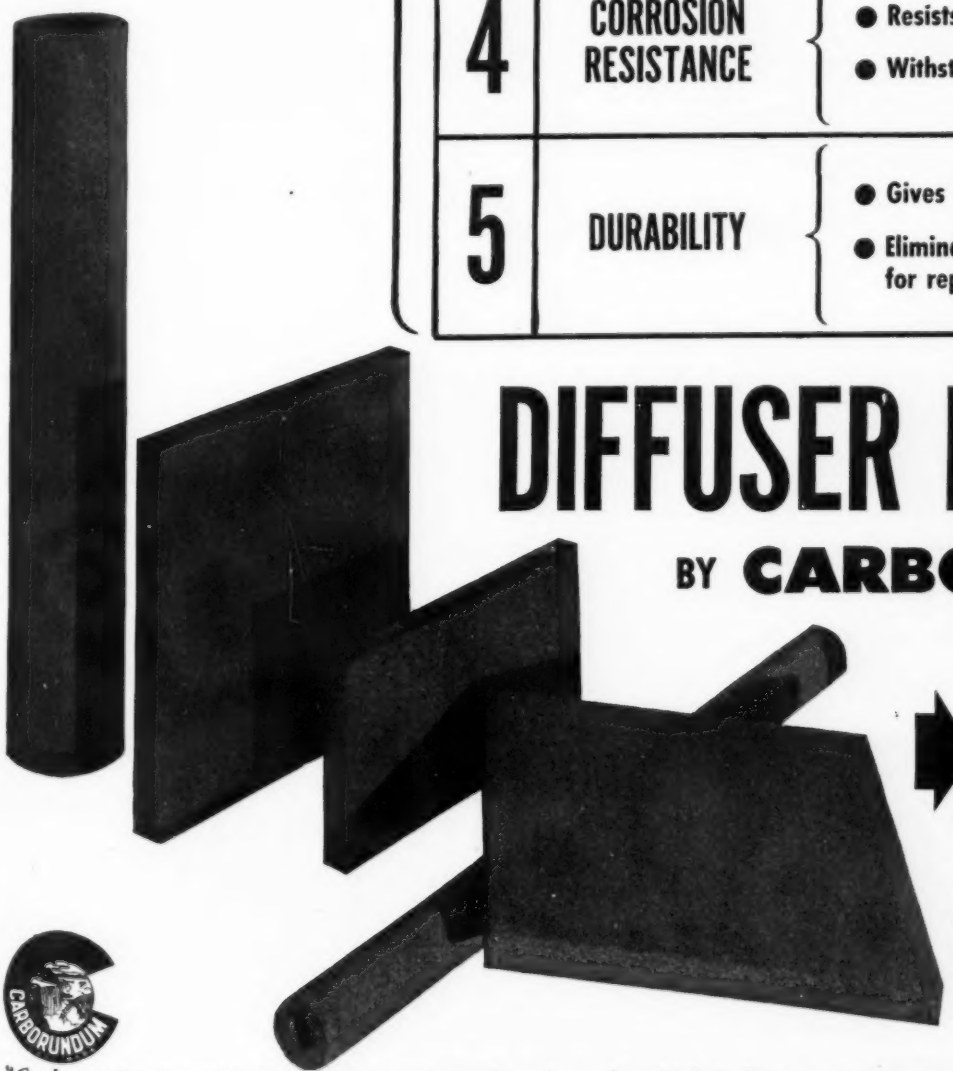
4	CORROSION RESISTANCE	● Resists chemicals in sewage ● Withstands chemical cleaning
5	DURABILITY	● Gives longer diffuser life ● Eliminates frequent shutdowns for replacements



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BY CARBORUNDUM

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Rugged!

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HYDRANTS

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VALVES: A.W.W.A. type iron body, bronze mounted with double-disc parallel seat or solid wedge type. Non-rising stem, outside screw and yoke, or with sliding stem and lever. Also furnished hydraulically operated. Square bottom type operates in any position. All rugged and dependable, made of best material with highest quality workmanship.

Hydraulically Operated: For remote control of operation and for quicker, easier opening or closing. Can be supplied in any of the standard sizes of M & H A.W.W.A. gate valves, either high or low pressure.

HYDRANTS: Standard A.W.W.A. type approved by Underwriters and Factory Mutuals. Dry top, revolving head, easy to lubricate. High efficiency because barrel diameter not reduced and there are no working parts or obstructions in waterway. SPECIAL TRAFFIC MODEL is designed to yield at ground line under impact, repair being simply renewal of breakable bolts and breakable coupling on stem.

M & H Shear Gate

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GATE VALVES	MUD VALVES
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WALL CASTINGS	FLAP VALVES
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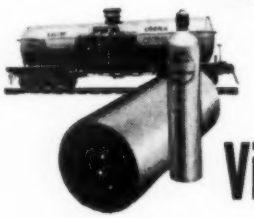

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WATER & SEWAGE WORKS

VOL. 94, NO. 8 AUGUST, 1947

A Gillette Publication

TREATMENT WORKS FOR PLATING WASTES CONTAINING TOXIC METALS AND CYANIDES*

By GEORGE E. BARNES
Head, Department of Civil Engineering
CASE INSTITUTE OF TECHNOLOGY
CLEVELAND, OHIO

THIS PAPER describes briefly the processes that have been developed and works that have been constructed to treat the plating wastes from Talon, Inc., at Meadville, Pa., over a period of some seven years. Starting with simple provision for neutralizing the spent pickling liquors with lime, improvements were begun in 1940 so as to remove cyanides and chromium along with other toxic metals such as copper and nickel. Changes have been made from time to time in method and in physical plant for accomplishing these purposes. There is now under construction at Meadville a new multi-purpose treatment works for complete treatment of all the wastes, designed on the basis of cumulative operating experience. Its fundamental features will be described. A similar one, somewhat smaller in capacity, has been approved for Talon's Works No. 3 at Hamden, Conn.

The Author

Nature and Origin of Wastes

The industrial wastes at Talon result from the manufacture of metal slide fasteners ("zippers"). In the production of these fasteners, certain steps are required such as forging, rolling, blanking, forming, and assembling of wire and fastener components made of copper, nickel, steel, zinc, aluminum, and zinc die castings. Electroplating may be required for copper, zinc, bright nickel, black nickel, chrome, oxidized, and other miscellaneous finishes.

Along with these operations, waste effluents will derive from four separate sources, i.e., (1) acid pickling baths, for descaling and decoloring, (2) nickel plating tanks, (3) the mill room, for burring, burnishing, washing, and cleaning, and (4) cyanide treatment as part of zinc and copper plating. The ingredients of the waste liquors are potentially troublesome when in sufficient volume or concentration if carried along with sewage to the municipal treatment plant or if discharged into the local watercourse, and the object of treatment is obviously to reduce their pollution effect as demanded under local conditions. The ingredients include (a) spent acids, largely sulfuric with some hydrochloric and nitric, (b) heavy metals including copper, nickel, chromium, and possibly zinc and aluminum, either in solution or suspension, (c) cyanides;

TABLE I
Estimated Quantities and Sample Analysis of Wastes

	(1) Nickel Plating Wastes	(2) Acid Wastes	(3) Mill Room Wastes	(4) Cyanides Wastes
Design flows (gallons per day)	10,000	25,000+	30,000	15,000
Chemical characteristics (ingredients in parts per million)				
Total solids	1,332	10,212	3,676	1,226
Loss on ignition	280	....	526	400
Suspended solids	38	68	654	72
Loss on ignition	8	....	226	24
Dissolved solids	1,294	10,144	3,022	1,154
Loss on ignition	272	....	300	376
Normal carbonate as $CaCO_3$	....	....	....	220
Bicarbonates as $CaCO_3$	118	....	....	332
Cyanides	....	....	....	129
Copper	10.4	100	50.0	....
Nickel	198	52	57.1	....
Chromium (total)	0	280	0	....
Chromium as chromate	....	78	....	....
Zinc	50	0	trace	....
Aluminum	0	0	0	....
Iron	....	30	....	2.25
Chlorides (Cl)	....	186	....	....
Sulfates as SO_4	....	6,414	....	....
Chlorine demand	411	....	452	596
pH	6.25	1.30	9.75	9.40
CaO in ppm. to bring pH to 11.0		600	....	....

*A paper written for *Water and Sewage Works*, and presented at the Third Industrial Waste Conference, Purdue University, Lafayette, Ind., May 22, 1947.

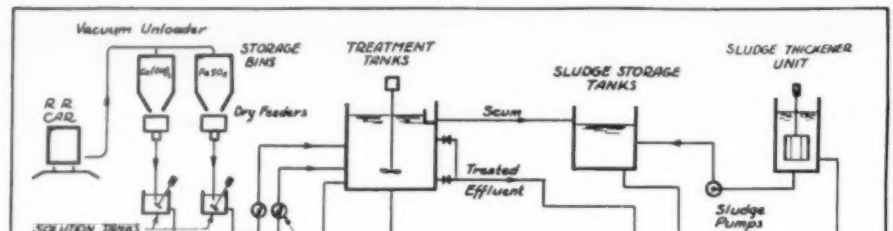

Fig. 1.—Flow Sheet of Acid and Cyanide Waste Treatment Works

and (d) soaps and oils or grease. The waste flow at Meadville at present is some 87,000 gallons daily, and provision is being made to treat 100,000 gallons daily.

Analysis of Wastes

The concentration and nature of suspended and dissolved matters in these wastes has been and will continue to be highly variable in character, varying not only with immediate production schedules but with changing production policy. Over a period of years, total solids up to 36,000 ppm., suspended solids up to 29,000 ppm., copper up to 3,700 ppm., chromium up to 22,000 ppm., nickel up to 500 ppm., and pH down to 1.6 have been encountered. Within recent years, the concentrations have been much more lean, and the accompanying analysis (Table I) is offered as a random sample of the general run of composites, though it would be hazardous to predict average values on which to base rigid stoichiometric calculations on future chemical dosages.

It is pertinent to remark here, parenthetically, that the suspended solids loading and biochemical demand of these particular wastes, and their corresponding "population equivalents," are of very secondary significance in the local pollution situation. Their pollution effect, on the contrary, is immediately related to the toxicity of cyanides, chromium, copper, and nickel, more or less in the order stated. A common measure of toxicity, indicating the nature and concentration of toxic matters in sewage, does not exist. Since this is a matter of growing importance to sanitarians and to industry, the writer proposes such a "toxicity index."

By experiment under controlled conditions, the digestion rate of a specified sewage sludge under the same conditions, but inoculated with various proportions of the untreated toxic waste, may be determined for purposes of comparison. The relative gas production may then be taken as the "toxicity index." It may be expressed on some arbitrary but convenient scale; for example, a toxicity index of 2 might be used to indicate that the gas production is one-half normal owing to the inhibiting effect of the waste. The relative toxicity of various substances in various concentrations so indicated, and their tolerance limits would be useful to know. Without some such procedure, our knowledge on these matters will remain scattered and unrelated, rather than cumulative.

Process Development

Investigation began in 1940 on the development of a process for carrying the treatment of these wastes beyond that of mere neutralization and such precipitation of the metals as could be accomplished by lime alone. The urgency for betterments arose from the fact that the City of Meadville complained of the effect of these wastes on sludge digestion at the municipal sewage treatment plant and on the further circumstance that the State of Pennsylvania would not tolerate their release into French Creek.

The problem of waste treatment was worked out in the sanitary engineering laboratories at Case Institute of Technology with respect particularly to the removal of chromium and cyanides. Chromic salts, and nickel and copper, were readily removed by precipitation as hydroxides with the application of lime to raise the pH above the point required for neutralization of the acid. Typical reactions are:

(1) $Cr_2(SO_4)_3 + 3\,Ca(OH)_2 = 3\,CaSO_4 + 2Cr(OH)_3$

(2) $NiSO_4 + Ca(OH)_2 = CaSO_4 + Ni(OH)_2$

(3) $CuSO_4 + Ca(OH)_2 = CaSO_4 + Cu(OH)_2$

To reduce the hexavalent chromium to the trivalent form, there were reported as the result of these experiments three practical methods, i.e.,

(1) application of ferrous sulfate,
(2) contact with iron turnings, and
(3) application of sulfur dioxide.

The second method was recommended, as requiring less rigorous control and less lime, and somewhat lower cost. However, a longer time element is required for the reaction to take place. Typical reactions are:

(4) $Na_2Cr_2O_7 + 6\,FeSO_4 + 8\,H_2SO_4 = 2\,NaHSO_4 + Cr_2(SO_4)_3 + 3\,Fe_2(SO_4)_3 + 7\,H_2O$

followed by treatment with lime as in (1) above. Chemical equivalents are 16.04 parts $FeSo_4.7\,H_2O$ to one part chromate as Cr.

For treatment of the cyanides, the formation of the deadly gas HCN by acid treatment, and its diffusion to atmosphere, (as has been practiced elsewhere), was not considered safe in this crowded community. As a result of the experiments, three feasible methods were reported for treatment of the cyanides, i.e., (1) formation of harmless soluble or insoluble salts or double salts of cyanogen, with excess iron and lime, (2) destruction of cyanides by hydrolytic conversion to soluble non-toxic ammonium formate, and (3) detoxification of cyanides by conversion to non-toxic cyanates by the use of oxidizing agents such as chlorine, chromates, permanganates, etc., or by conversion to thiocyanates with sulfur compounds. The first method was recommended, as the reaction would take place anyhow with iron and lime treatment, up to certain limits. If residual cyanides appeared, it was further recommended that the excess be taken out by the application of $NaHSO_3$ to form the thiocyanates as in (3).

Continuous Flow Treatment Works

A continuous flow plant operating on this process was designed and

built in 1941 and has been in operation up to the present. Its rated capacity is 20,000 gallons per day. Essential elements are (1) an iron contact chamber where the raw acid wastes are introduced for reduction of chromates, (2) a neutralizing chamber where milk of lime is introduced and the mix flocculated, and (3) a settling basin with sludge removal equipment. The cyanide wastes are introduced into the flow immediately after neutralization. The plant has been completely described previously.*

Supplementary Facilities

With waste flows increasing to a present figure of 87,000 gallons daily, the original plant would be badly overloaded, and supplementary treatment has been provided pending construction of a new plant. First, it has been necessary to add ferrous sulfate to supplement the iron contactor arrangement. Present monthly average dosages are from 1,000 to 2,000 or more pounds of lime, and 1,200 to 3,500 pounds of ferrous sulfate daily. Operating results for a current period are shown in Table II.

TABLE II
Treatment for Metals Removal During April, 1947

	Acid Wastes Neutralized Gallons Daily	Pounds of Lime Daily	Pounds Ferrous Sulfate Daily	pH (final)
Max.	27,000	1,850	2,800	8.4 plus
Min.	2,000	250	200	do
Av.	15,142	1,251	1,756	do

Residual chromium, copper; less than 10 ppm.

Secondly, the cyanides have increased in concentration and separate treatment for them has been provided. For a period of several weeks, excess cyanides were treated with sodium acid sulfite, as originally recommended. With this treatment it did not seem possible to get the cyanides down to less than 25 ppm., which was not satisfactory. Tests were then again conducted under the author's direction, at Allegheny College in Meadville, on cyanides removal with ferrous sulfate and lime and also by chlorination. The former method, while effective, was not adopted because of the sludge handling required; chlorination was adopted. Dobson** reports that under alkaline conditions, the basic reaction is:

(1) $NaCN + 2\,NaOH + Cl_2 = NaCNO + 2\,NaCl + H_2O$

TABLE III
Treatment of Cyanides Wastes During April, 1947

	Gal'ons Treated Daily	Cyanides Content (ppm.) Before Cl_2	Cyanides Content (ppm.) After Cl_2	Cyanides Content (ppm.) After Lime	pH Before Cl_2	pH After Cl_2	pH After Lime	Lbs. Chemical Used Chlorine Cl_2	Lbs. Chemical Used Lime CaO
Max.	28,634	1,117	4.84	3.8	12.3	11.5	11.8	228	750
Min.	14,716	124	0.52	0.1	10.2	5.4	7.1	47	100
Av.	20.166	212	2.5	1.2	11.2	7.5	9.5	73.6	195

Lime is applied for removal of small quantities of copper.
Residual chlorine content = 0.00 throughout.

In this reaction, 2.70 parts Cl_2 are equivalent to 1 part CN. The cyanate which is formed is a very low order of toxicity, negligible for almost any conceivable condition of disposal. If free chlorine residual is found after the reaction is completed, no cyanides exist.

Upon further application of chlorine, the cyanate breaks down into harmless carbon and nitrogen by-products as follows:

(2) $2\,NaCNO + 4\,NaOH + 3\,Cl_2 = 6\,NaCl + 2\,H_2O + 2\,CO_2 + N_2$

Here, 4.05 parts Cl_2 are equivalent to 1 part CN.

This batching plant consists of two circular wood tanks of 30,000 gallons capacity each. One tank acts as a holding tank, and the other as a treatment tank, alternating daily. Depending on cyanide concentration, the volume of chlorine solution may be anything up to the volume of the wastes treated. The chlorine is applied over a period of several hours, and the treated waste, after testing for condition, is dribbled at a constant rate to the sewer. The equipment was selected so as to be usable in the complete treatment works now being built.

Current operating figures are shown in Table III.

*"Treating Pickling Liquors for Removal of Toxic Metals," George E. Barnes and Mathew M. Braidech, *Engineering News-Record*, Oct. 8, 1942.

**"Cyanide Waste Treatment with Chlorine," John G. Dobson, Technical Service Division, Wallace & Tiernan Co., Inc. Paper presented at the Third Industrial Waste Conference, Purdue University, Lafayette, Ind., April 22, 1947.

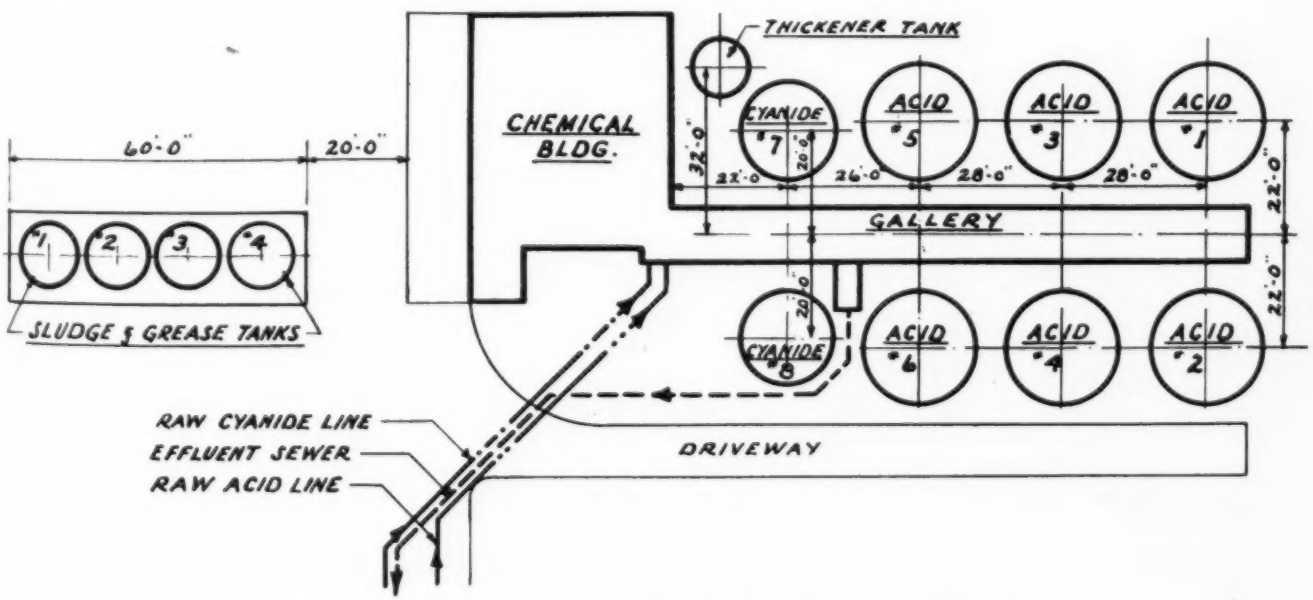

Fig. 2.—Plot Plan of Acid and Cyanide Waste Treatment Works

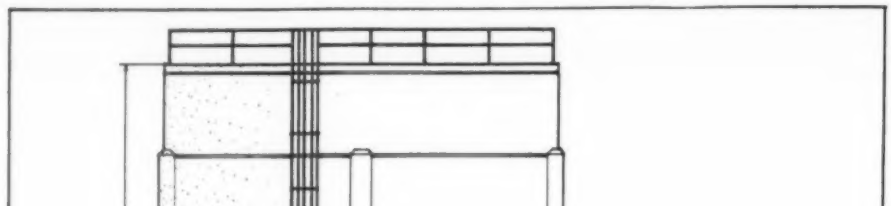

Fig. 3.—Elevation of Acid and Cyanide Waste Treatment Works

It has been found that the emptying of the tank releases some nitrogen trichloride to atmosphere. This gas is a nuisance in the neighborhood. In the plant now under construction, the tanks are to be hooded and the atmosphere over the liquid level will be passed through an absorption tower to obviate this condition.

Basis of Design for New Treatment Works

The new treatment works will be a multi-purpose plant consisting of (1) facilities for the treatment of spent pickling liquor, nickel plating wastes, and mill room wastes combined, by means of ferrous sulfate and lime; and (2) facilities for the treatment of the cyanides wastes by chlorination, with additional provision for removal of copper which occurs in these wastes also, in small quantities. It will thus be in fact two plants operating in parallel, but interconnected; one of the treatment tanks being a dual purpose tank to handle either type of treatment at will. Careful laboratory studies preceded the decision to treat the wastes in this combination, as compared with alternate combinations. Major considerations are (a) mixing the mill room wastes with the acid wastes to add alkalinity and to save lime, and getting the effect of acid coagulation on the mill room wastes for better separation of soaps and oil to be skimmed off; and (b) forming a minimum of sludge by treating the cyanides wastes separately by chlorination as contrasted with iron-lime treatment. The batch type of plant is adopted rather than the continuous flow type, because of the more perfect control and economy in chemical dosage which is possible, and in the light of unpredictable changes in the character of the wastes which are likely to occur. The rated capacity will be 100,000 gallons daily, including the volume of chemical solutions to be applied.

Flow Sheet

The Flow Sheet shown in Fig. 1, indicates the steps in handling and treating the wastes.

The cyanides wastes will be collected by gravity in holding tanks (these will be the present continuous-flow plant tanks converted), and pumped to one of two 30,000 gallon capacity circular, wood, treatment tanks, in which they will be chlorinated and, after testing, released to the sewer at a mechanically-controlled rate. These tanks will be equipped with vertical shaft, impeller-type agitators, and will be hooded to collect the atmosphere above the chlorinated liquid. This atmosphere will be drawn off by exhaust fans and passed upward through an absorption tower to dissolve any vapors containing nitrogen trichloride. A cascade outlet on the sewer gives further opportunity for capturing any vapors that might go along with the effluent. The tankage is ample to allow a day for accumulation, a day for transfer and treatment, and a day for release of the treated cyanides waste.

All other wastes (acid, nickel plating, and mill room), will be collected in existing holding tanks underground, and pumped to one of six 45,000 gallon capacity circular wood treatment tanks. These tanks will be equipped with suitable agitators, baffled decanting outlets, skimmers, and sludge drawoff pipes. From the chemical building, milk of lime and ferrous sulfate solutions will be separately pumped to these tanks. The tankage is ample to allow a day for accumulation, a day for transfer and treatment (determination of the dosage, application of the chemicals, agitation, and settling), and a day for emptying (skimming, drawing sludge, and discharge of supernatant). As with the chlorination tanks, the effluent rate is mechanically controlled.

Special provision is made for concentrating the sludge. Sludge drawn from the treatment tanks will flow by gravity to the sludge well, and will be pumped to the thickener unit. This unit will be equipped with special slowspeed type of thickener mechanism. The thickened sludge will be pumped to storage, and carted away about once a week to a lagoon on the outskirts of the city. The supernatant from the thickener will be recycled to the system. A by-pass around the thickener, direct to storage from the sludge pit, provides for emergency shut-down of the unit. It is expected that the daily raw sludge yield will be about ten per cent of the treated flow, and that thickening will result in substantial reduction of this volume.

Oil and grease will be taken at the surface of the acid treatment tanks over a weir, with a skimming mechanism, and drained to a sludge storage tank.

Chemical storage and feeding facilities are grouped in the chemical building. Chlorine containers of one-ton capacity will be trucked in and unloaded by tramrail to cradles, and thence moved forward to the scales to be connected with the chlorinator, which will have a delivery capacity of 2,000 pounds daily. Bulk pebble lime and super-dried ferrous sulfate will be brought into the plant by rail, and unloaded by vacuum equipment to a receiver atop twin 80 ton capacity concrete storage bins, one for lime and the other for ferrous sulfate. A switch under the receiver permits it to serve both bins. The bin for ferrous sulfate is furnished with dehumidification equipment. Directly under these bins are the dry chemical feeders of 500 pounds per hour capacity, one for ferrous sulfate, and the other (with slaker) for lime. The dry chemicals will be dissolved in solution tanks holding a day's batch, which, at known concentrations, will be pumped in measured quantities to

the treatment tanks through individual solution pipe or hose.

The effluent rate is to be controlled, and also continuously sampled. This will give most complete control on performance. Other equipment includes suitable rate of flow indicators on the chemical feed lines, liquid level indicators on the tanks, and convenient sampling devices at key points.

General Layout

The general arrangement of the plant units is shown in Fig. 2. The accumulation tanks are adjacent to the Talon main works, and are not shown. The treatment works includes the chemical building, the treatment tanks, the operating gallery, and the sludge storage tanks. The chemical building is under the bulk chemical storage bins, with chlorine storage platform alongside. On the ground floor are the chemical room, housing dry feeders and vacuum pumps; the chlorinator room, housing chlorinator and scales; the chemical control laboratory, equipped with standard furniture and apparatus; and stairways leading to the operating gallery and substructure respectively. In the substructure are the chemical solution tanks, the sludge well, and chemical feed and sludge pumps. The operating gallery has influent, effluent, and sludge headers from the various tanks placed along the walls, and chemical feed lines hung from the ceiling. It is partly below and partly above ground, well drained, lighted, and ventilated. Most of the operations can be controlled indoors. The treatment tanks are on either side of the operating gallery, mounted on concrete pedestals, and provided with walkaways atop, for inspection, sampling, and maintenance generally of exposed equipment. The sludge storage tanks are at a level to drain into the trucks by gravity.

The arrangement of the plant units and the space provided is such as to permit expansion or extension of the works, without major changes in the structures now being built.

Fig. 3 shows the general appearance of the chemical building, chemical storage tanks, and operating gallery, the latter being much shortened in the figure.

Studies on Sludge Filtration

Mechanical means of sludge dewatering have been studied in the laboratory, to investigate possible alternates to sludge trucking and lagooning. The most successful method has proved to be by pressure filters; but the estimated cost of equipment, housing, and operation appears to be higher than that incident to disposal as herein provided, for this particular installation. No broad generalization on this subject is warranted.

Concluding Remarks

Over a period of about seven years, the matter of treating plating liquors and cyanide wastes at Talon, Inc., has been studied intensively by laboratory methods and through firsthand operating experience, to keep this phase of plant operation in line with the usual economies and efficiency expected by industrial management of operations generally. This experience enables the corporation to move with some assurance on the making of a major investment in an important betterment, owing to the fact that there is to be no element in the new plant which has not been, in some manner, fairly well tested. The methods employed and herein described are a logical development of a particular situation. One must always keep in mind that industrial waste treatment is always conditioned by local circumstances and internal conditions peculiar to a given locality and a given industry. In other words, one must come down to cases; not only with respect to the chemistry of a process, but with respect to detailed layout, design, and operating considerations.

Acknowledgments

Acknowledgment is due many persons who have contributed to the work. The cooperation of C. H. Young, District Engineer for the Pennsylvania Department of Health, and of Roy L. Phillips, City Engineer of Meadville, Pa., is gratefully acknowledged throughout.

In the development of the new works particular acknowledgment is due Cleaveland C. Judd, Production Manager, John J. Williams, Plant Manager, H. E. Freund, Plant Engineer, Harry W. McElhaney, Head of the Plating and Mill Room Departments, R. A. Bolon, Senior Chemist, and W. L. Hardenburg, Chemist, all of Talon, Inc. At Alleghany College, Professors J. E. Cavelti and H. S. Rhinesmith made tests on cyanides removal, as described herein.

The early basic experiments on chromium removal and cyanides treatment were made jointly by the author and his former associate, Mathew M. Braidech, then Professor of Industrial and Sanitary Chemistry at Case Institute of Technology. In the latter phases of the work, particularly the experiments on sludge filtration, the laboratory work has been done by his present associate, Dr. R. C. Weast, Assistant Professor of Chemistry at Case.

Construction drawings and specifications for the work were prepared by Wilbur Watson Associates, Cleveland, Ohio, under the immediate supervision of Mauno O. Backlond, member of the firm. All of the development work and design pertaining to the work has been under the direction of the author, as consulting engineer to Talon, Inc., and to Wilbur Watson Associates.

Meadville Plant of Talon, Inc.—Waste Treatment Plant Pictured on Front Cover

FLUORIDE REMOVAL*

Featured in What Is Believed to Be the Largest Plant of Its Kind, as Well as the World's Loftiest Softening Plant

By
ROBERT WAMSLEY and W. E. JONES
Plant Sup't Safety Director
CLIMAX MOLYBDENUM CO.
CLIMAX, COLO.

ONE of the earliest problems in the life of any community is the provision of an adequate supply of water sufficiently free from all types of contamination to be suitable for domestic purposes.

Generally speaking, the location of most communities is determined to a great extent by the availability of an adequate supply of satisfactory water. For a mining camp, that consideration cannot be foremost. Here the ore takes first place, and the men who mine it must do the best they can under the existing conditions. If there is no local source of water, it must be brought from some distant source or must be found by sinking shafts or drilling wells. Fortunate indeed is the mining company that discovers a commercially valuable ore deposit beside a never failing creek full of pure water, with sufficient water rights available, because the acquisition of water in any other manner nearly always involves not only a considerable period of time but the expenditure of considerable money.

Problems of Suitable Supply

The experience of Climax Molybdenum Co. demonstrates the measures that sometimes are necessary in order to provide a suitable supply of water. The Climax mine and mill are on the Continental Divide, about 13 miles northeast of Leadville. The elevation of the domestic part of the camp varies from a minimum of 11,320 ft. to a maximum of approximately 11,550 ft. above sea level, and, as is common at such altitudes, the near-by streams that might be suitable for a water supply are small and intermittent, usually flowing only during the summer months. The only streams of any size in the immediate vicinity of Climax are the Ten Mile and Arkansas Rivers. The headwaters of Ten Mile River are on the company's property, and its water has been used for the domestic supply. The headwaters of the Arkansas River

*This paper, read before the Colorado Mining Assn., is reproduced through courtesy of the Am. Inst. of Mining and Metallurgical Engrs. It also appears as Technical Publication No. 1913 in the Institute's journal, *Mining Technology*.

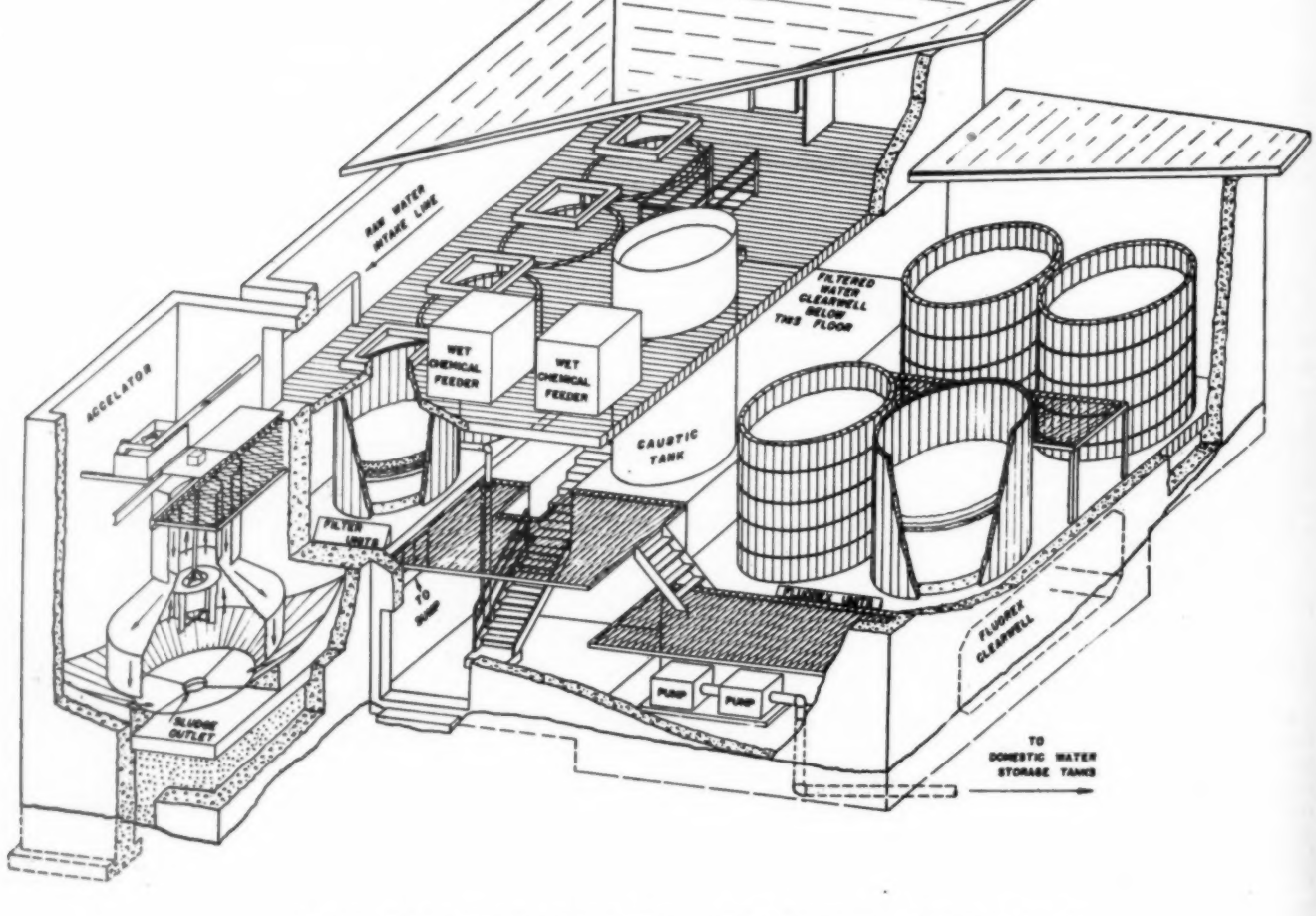

Fig. 1.—Water-filtration Plant, Climax Molybdenum Co., Climax, Colorado.

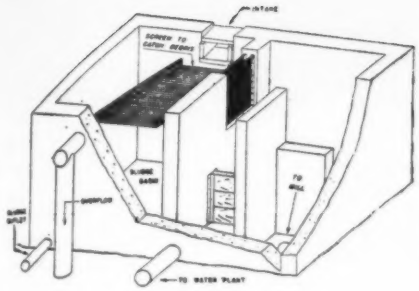

Fig. 2.—Intake Screen.

are about 2 miles distant and have not been used as a source of supply by the company.

During the 11 years of the production of molybdenum at Climax, the number of families living there has increased from about 45 to 283, and the population has increased from about 200 to 1200 persons. Consequently, the capacity of the water-treatment facilities, and the amount of water available, had to be increased to meet the requirements of the camp.

As early as 1932 it was recognized that the water in Ten Mile River would not continue to be adequate for domestic purposes and after considerable discussion it was decided to drive a drift through the major fault in an effort to find additional water. This drift was completed in 1935 and tapped sufficient water to make the supply adequate. This water was treated in a tank underground, where lime was added, and was then piped into the domestic supply lines.

At about the time this line was completed, the presence of fluorine in harmful concentrations was discovered in the water. This problem was submitted to the International Filter Co. and in November, 1937, a plant of its design was put in operation for treating the water to remove the fluorine. This plant proved entirely successful, and took as much of the mine water as was required for domestic use. Several years later, with the increase in population, its capacity proved inadequate and plans were made to enlarge it. Because of delays caused by the war the enlarged plant was not placed in operation until October, 1943. According to information available here this plant is the largest of its kind in the world and it is hoped that a description of its equipment, operation, and the results obtained will be of benefit to companies confronted with the same or similar problems. (Fig. 1.)

Analysis of Water

The mine water used for the raw water supply is relatively soft, ranging from 80 to 250 parts per million total hardness. The turbidity of the water varies considerably. At times the water is clear and at others it contains a high percentage of mud and colloidal material. These changes are very rapid, taking place within a few minutes, and necessitate adjustments at irregular intervals in the softening and settling processes. The "accelator" unit with the new plant is much more flexible in handling this kind of situation than the ordinary settling basin. Water of approximately 80 parts per million hardness is desired. It is rather a problem to produce a water of this hardness that is absolutely neutral in alkalinity or slightly on the acid side in pH.

The analysis in Table I is representative of the water as it enters the filter plant.

One of the difficulties encountered in delivering the raw water to the water plant was an excessive amount of fine sand, chips and miscellaneous debris carried out of the mine in the flume. This condition was remedied by constructing a combination self-cleaning screen and settling box (Fig. 2). This box has two compartments, each approximately 10 ft. square and 8 ft. deep. The influent falls from the flume directly on an inclined screen with ¼-in. mesh. Chips and other debris carried in by the stream of water are washed up on the screen, leaving a clean area for the passage of the water through the screen. The sand and gravel carried in by the water are deposited in the first basin, or settling area. This material is discharged to a waste line by a manually operated blowoff valve in the bottom of the settling basin. From the settling basin the water passes through two vertical screens of ¼-in. mesh set in an opening near the top of the partition separating the

TABLE I
Representative Analysis of Raw Water

Determinations Made	Parts per Million[a]
Physical	
Turbidity	7.0
Color	7.0
Odor	None
Chemical	
Calcium (Ca)	78.0
Magnesium (Mg)	7.0
Sodium (Na)	6.0
Alkalinity (as CO_3)	16.0
Sulphate (SO_4)	199.0
Chloride (Cl)	2.0
Iron (Fe)	0.4
Manganese (Mn)	1.8
Silica (SiO_2)	14.0
Fluorine (F)	16.0
Free carbon dioxide	3.0
Mineral acidity (as $CaCO_3$)	0.0
pH	7.4

Hypothetical Combinations	Parts per Million
Calcium carbonate	27.0
Calcium sulphate	228.0
Calcium chloride	0.0
Magnesium carbonate	0.0
Magnesium sulphate	35.0
Magnesium chloride	0.0
Sodium carbonate	0.0
Sodium sulphate	13.0
Sodium chloride	4.0
Iron oxide: unfiltered	0.6
Silica	14.0
Total dissolved solids	322.0
Alkalinity (M) as $CaCO_3$	27.0
Total hardness as $CaCO_3$	224.0
Calcium hardness as $CaCO_3$	195.0
Magnesium hardness as $CaCO_3$	29.0
Noncarbonate solids as $CaCO_3$	209.0
Total solids as $CaCO_3$	236.0

[a]To convert parts per million to grains per gallon divide by 17.12.

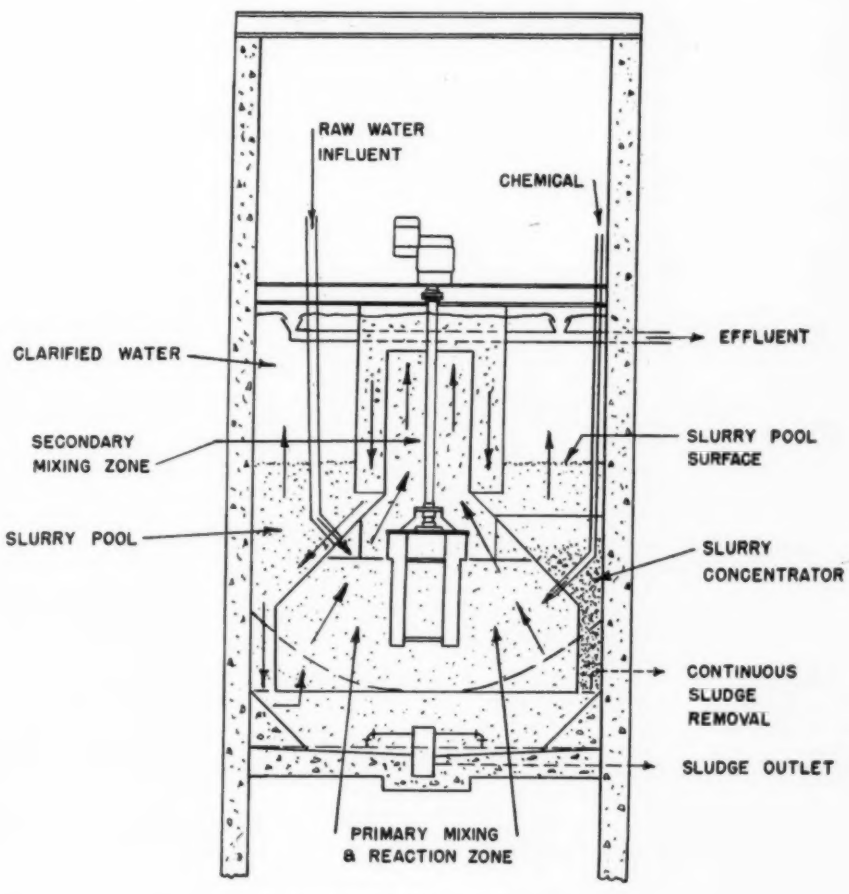

Fig. 3.—Cross Section of Accelator.

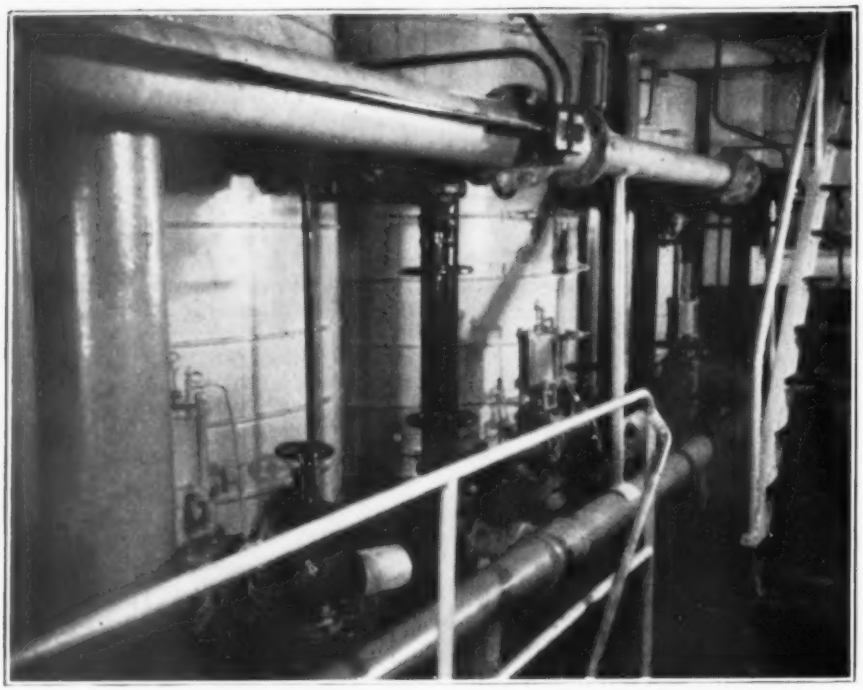

Fig. 4.—Three of the Four Rapid Sand Filters.

two basins, and flows into the distribution basin. The effluent to the water-purification plant is placed at the bottom of this basin and 4 ft. above this outlet is another outlet for water to the mill.

The flow of water into the water-purification plant is regulated by a balanced float valve operated by the water level in the accelator unit. This permits a constant flow from the distribution basin of the accelator while permitting an intermittent flow to the accelator unit.

Method of Treatment

The principle of the method of treatment is based on the intermittent flow to the accelator unit and constant flow from it to the sand filters when they are in operation. The accelator is one of the most recent and most successful developments in the field of water sedimentation and softening (Fig. 3). It is a concrete tank, 12 ft. square and 15 ft. deep. The main parts of the interior of the unit—the conical reaction and mixing chamber and the cylindrical portion of the unit for the recirculation of water in the process of treatment—are of sheet steel. In the center of the unit is mounted a small motor with a variable speed reducer attached to an impeller, which serves the purpose of mixing and circulating the water being processed. The sides near the bottom of the tank are built at about a 60° angle, to concentrate the heavy sludge and solids in the center of the bottom of the tank for removal through a manual blowoff system. In one corner is a three-cornered area for depleted sludge and slurry, which is removed by an automatic blowoff system controlled by an electric timer.

The raw water enters the accelator and flows down to the primary mixing and reaction zone. This zone is confined within the conical part of the unit, and is approximately 4 ft. from the bottom of the tank. The coagulating chemicals are added in this zone by a standard wet chemical feeder. The partially treated water is then mixed and lifted by the impeller up through the central part of the unit and circulates down into the slurry pool. The clarified and softened water is forced up out of the slurry and flows to the sand filters through four conical collector cups near the top of the accelator unit.

The flow of water from the accelator is controlled by a 10-in. balanced float valve which in turn is actuated by the water level in the sand filters. There are four of these filters, and each is a wooden tank, 7 ft. in diameter and 8 ft. high. Their filtering rate is 85 gal. per min. each, making a total of 340 gal. per min. when all four units are in operation.

The filters used are the rapid, sand, gravity type (Fig. 4). They use several standard grades of sand and gravel as filtering media to make a bed 18 in. deep. This type of filter requires washing about once in 24 hr., depending on the clarity of the water being fed to it.

The filtered and softened water is passed through a recarbonation chamber (Fig. 5) to neutralize excess alkalinity. The carbon dioxide used for this purpose is obtained from a medium sized oil burner. To get the gas into the recarbonation chamber, two Nash Hytor gas compressors are used. These draw the gas from the oil burner through two water scrubbers into the compressors, and then force it through the driers and into the grid of pipes in the recarbonation chamber, where it escapes through small holes. From the recarbonation chamber the water flows into a water well (a surge tank) from which it is pumped to the Fluorex units as required.

Fluorine Removal

The fluorine-removal units (Fig. 6) are redwood tanks, in all appearances similar to the gravity type of filters. Each tank is 8 ft. 6 in. diameter and 10 ft. high. Lateral pipes rest on the bottom. About three-fourths of the way to the top of the tank is a caustic distributor divided into four sections, each of which covers one-fourth of the area of the tank. Each section consists of a section of 3-in. pipe with holes drilled in one side. These holes are turned so that the caustic solution strikes the bed at about a 15° angle.

Just above the caustic distributor is the wash trough, which is built to act as a weir in the back-washing operation and to distribute evenly the incoming filtered water when the units are in operation.

The filter media used in each unit consist of 45 in. of tricalcium phosphate, 4 in. of extra fine gravel, 3 in. of fine gravel, and 5 in. of medium gravel. The water to be treated comes in at the top of each tank and percolates down through the bed and out of the unit at the bottom. It is during this period that the fluorine in solution is absorbed by the tricalcium phosphate. The loss of filter media from the beds is negligible.

All influent and effluent water is controlled by floats and balanced float valves. When one unit is out of operation, or is being regenerated, the load is automatically taken by the remaining units.

The caustic solution and CO_2 rinse use the same pipe line to the fluorine-removal units. The units are backwashed by reversing the flow of water. This is accomplished by pumping water in at the bottom of each unit and allowing it to spill over into the wash trough and go to waste.

The combined capacity of the four units is a net of 300,000 gal. of treated water in 24 hr. from raw water con-

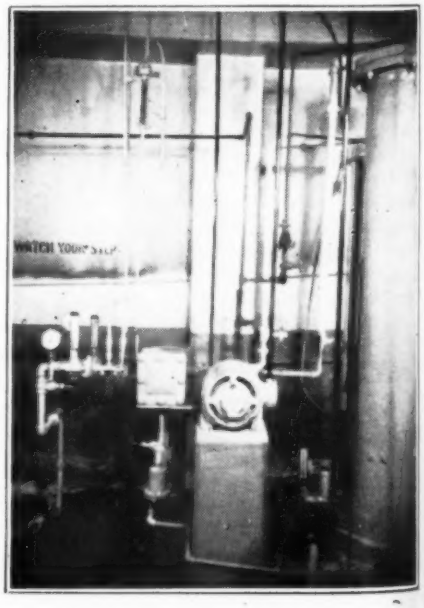

Fig. 5—Recarbonation Unit.

taining 14 parts per million fluorine. As the fluorine content of raw water in Climax has varied from 2 parts to more than 14 parts, the capacity may be proportionately more or less.

From these units the water is fed by gravity to the clear-water well, where it is chlorinated. Then it is pumped to the tanks for domestic supply. These tanks are at an elevation of 11,660 feet.

The most complicated and time-consuming operation in the Climax water-purification plant is the regeneration of the Fluorex units. This requires approximately 3 hr. per unit and one or two units are regenerated each day, depending on the fluorine content of the water and the demand for treated water. This procedure is as follows:

1. Back-washing until the water is reasonably clear.
2. A caustic rinse to convert insoluble calcium fluoride to soluble sodium fluoride.
3. A clear water rinse to wash out the remaining caustic solution.
4. A carbonic acid rinse to bring the pH as near 7 as possible.
5. A final clear water rinse to remove any gas bubbles that may remain in the bed.

The caustic rinse is derived from a 1 per cent caustic soda solution, which is fed by gravity to the unit being regenerated and is returned to the caustic-solution supply tank by a pump. The caustic solution is distributed evenly over the bed of tricalcium phosphate by the distributor system previously mentioned. The carbonic acid rinse and clear water rinse are distributed through the same pipes. The carbon dioxide for the carbonic acid rinse is derived from dry ice. The dry ice is broken into small pieces and placed in steel converters that hold 170 lb. of dry ice each. It is allowed to change to a liquid and is then used in making carbonated water.

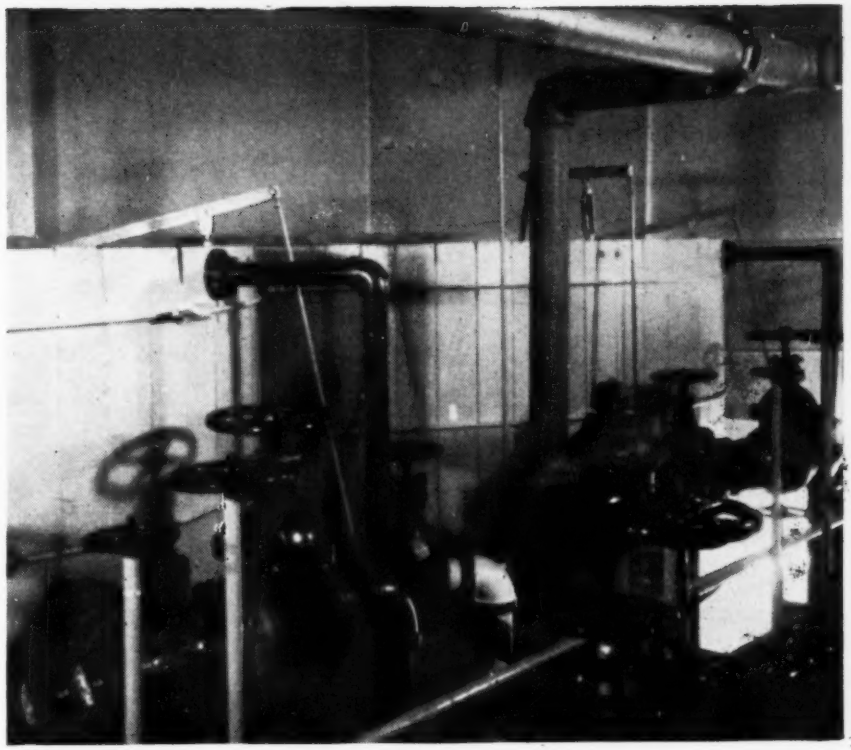

Fig. 6.—Two of the Four Fluorex Units.

The carbonators are merely steel tanks with an Aloxite diffusion cylinder in each one. They are arranged so that clear water is pumped in at the top and the carbonated water is forced out at the bottom.

The operation of the plant is virtually automatic, except for the filling of the chemical feeders (Fig. 7), back-washing of filters and the regeneration of the fluorex units.

Fig. 8 shows the flowsheet and Table II the operating data of the plant.

Plant Operation

When the water level drops in the supply tanks on the hillside above the camp, a pressure governor starts the main pumps in the filter-plant building. After these have operated for a short time, the water level in the clear-water well drops, causing a float switch to start pumping water from the filtered-water well to the fluorex units. After the water level in the filtered-water well has dropped a certain distance, it causes another float switch to actuate four solenoid coils, which cause the rate controllers on the filters to open, thus putting the filters into service. When

TABLE II

Operating Data

	Raw Water*									Base Charges, Lb.		Actual Charges Used**				Fluorex Regeneration Chemicals Used, Lb.		Softened and Filtered Water*							Laboratory Tap Water, Per Cent	Metered Flow to 4:30 P.M.,
Date	pH	CO_2	P	M	CaH	MgH	TH	Fl	Lime	Soda Ash	Water, Gal.	Lime, Lb.	Soda Ash, Lb.	Sod. Al, Lb.	Caustic	CO_2	CO_2	P	M	CaH	MgH	TH	Cl	Fl		Gal.
Sun. 13									200	400	146 170	67	67 80	4	225 225	85 85	11	0	77	58	17	75	0.2	0.5		128,100
Mon. 14									200	400	218 275	100	100 126	6	225 225	85 85	15	0	130	78	12	90	0.2	0.6		143,700
Tues. 15	7.0	22	0	29	168	24	192	12	200	400	262 306	120	120 140	7	225 225	85 85	13	0	127	85	7	92	0.2	0.5		194,000
Wed. 16									200	400	284 240	110	130 110	6	225 225	85 85	10	0	120	81	13	94	0.2	0.5		136,000
Thurs. 17									**200**	**400**	**249** 192	88	**114** 88	**5**	**225** 225	**85** 85	**12**	**0**	**123**	**84**	12	96	0.2	0.6		120,200
Fri. 18	6.8	19	0	32	174	31	205	13	200	400	227 184	84	104 84	5	225 225	85 85	11	0	119	79	15	94	0.2	0.5		98,000
Sat. 19									200	400	227 184	84	104 84	5	225 225	85 85	14	0	124	75	14	89	0.2	0.7		106,200
Totals											3,165	653	1,451	38	3,150	1,190										926,200

*P, phenolphthalein alkalinity; CaH, calcium hardness; TH, total hardness; M, methyl orange alkalinity; MgH, magnesium hardness; Cl, chlorine; Fl, fluorine; all reported in ppm.

**Base Charges, Computation; Lime (90 per cent) = (M + MgH + (2.3 × free CO_2)) × 0.75 + 7.6 (lb.) Soda ash = (TH — M) × 0.975 + 10.5 (lb.) Sodium aluminate = minimum to get good flocculation, 10 to 20 lb. All based on 103 gal. per min. raw water, 17½ hr. for full base charge.

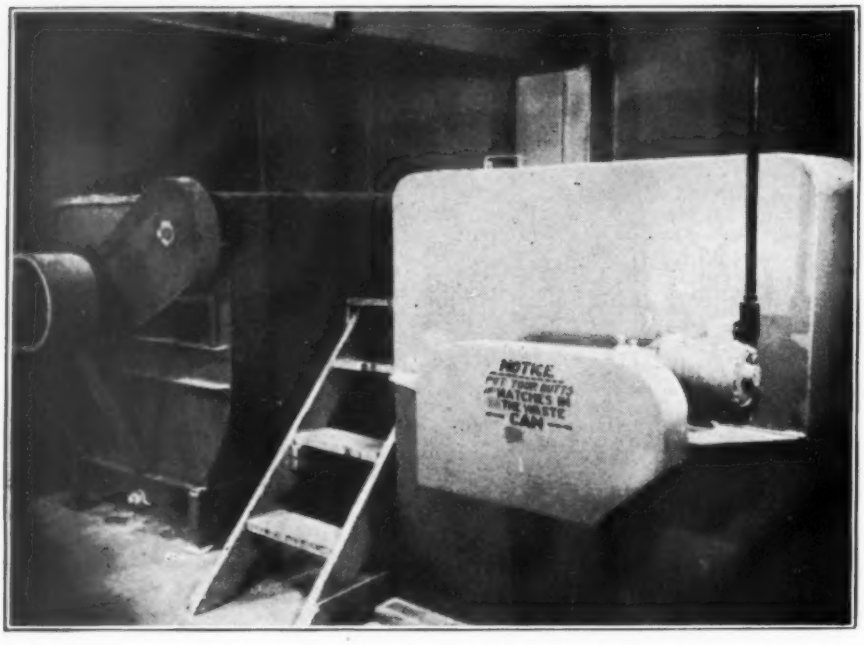

Fig. 7.—Chemical Feeders.

Fig. 8—Flowsheet of Climax Water Purification Plant.

Gross capacity, 400,000 gal. per day; net capacity, 300,000.

the filters have been in service for a few minutes, the water level in the accelator unit drops, causing a float valve to open to allow raw water to go to this unit. At the same time, a switch connected to the raw-water control assembly starts the chemical feeders, placing the whole unit in operation.

There are times when the fluorine content of the raw water is much higher than at others (Fig. 9). This always occurs during the coldest part of the winter, when little or no surface water runs through the mine. During the spring and summer months, when the runoff is greatest, the fluorine content of the water drops to a low of two parts per million.

In order to facilitate the training of new operators and the making of repairs, a color code was adopted for all pipe lines to designate their contents. Differentiation is made also between high-pressure and low-pressure lines, so that appropriate safety precautions may be observed when necessary.

Because of the complexity of the treatment required by the water, the transportation charges on supplies, and the wage scale in force, the cost per million gallons treated is considerably higher than would normally be expected. Table III gives the present cost of operating the plant at an average subnormal rate of 2,962,600 gal. per month. The actual capacity is approximately 9,120,000 gal. net per month.

Approximately 60 per cent of the cost shown can be charged to the fluorine-removal treatment. When the plant is operated at capacity, the cost per million gallons of water treated is approximately $100 less than that given in Table III, owing mainly to the fact that the present crew of an operator and one part-time assistant is sufficient to operate the plant at its maximum capacity.

The total cost of the plant was slightly over $100,000 and about one-half this amount represents the cost of the equipment.

In order to ensure complete control over the quality of the water delivered for domestic consumption, a program of testing has been set up and is carefully followed. The treated water is tested daily for alkalinity, carbon dioxide, hydrogen-ion concentration, soap hardness, fluorine and residual chlorine. The raw water is tested at least twice a week and more often if necessary. All this work is done in accordance with the recognized proper procedures as stated by Theroux, Eldridge and Mallman.* In addition, bacteriological examinations conform with the standards recommended by the American Public Health Association.

The operation of the plant has been entirely satisfactory and the anticipated performance of the various units was obtained under actual operating conditions. Both the accelator unit and the fluorine-removal units, which are the unusual features of the plant, have functioned exceptionally well, and no serious difficulties have been experienced in maintaining a suitable quality and quantity of water for domestic consumption.

*F. R. Theroux, E. F. Eldridge and W. Le R. Mallman: Laboratory Manual for Chemical and Bacterial Analysis of Water and Sewage, Ed. 3. New York, 1943. McGraw-Hill Book Co.

TABLE III.

Cost of Operation.

Item	Average Cost per Month	Cost per Million Gallons
Operating labor	$ 468.85	$158.25
Repair labor	16.27	5.49
Operating supplies	554.11	187.04
Repair supplies	13.19	4.45
Power	34.03	11.49
Total	$1,086.45	$366.72

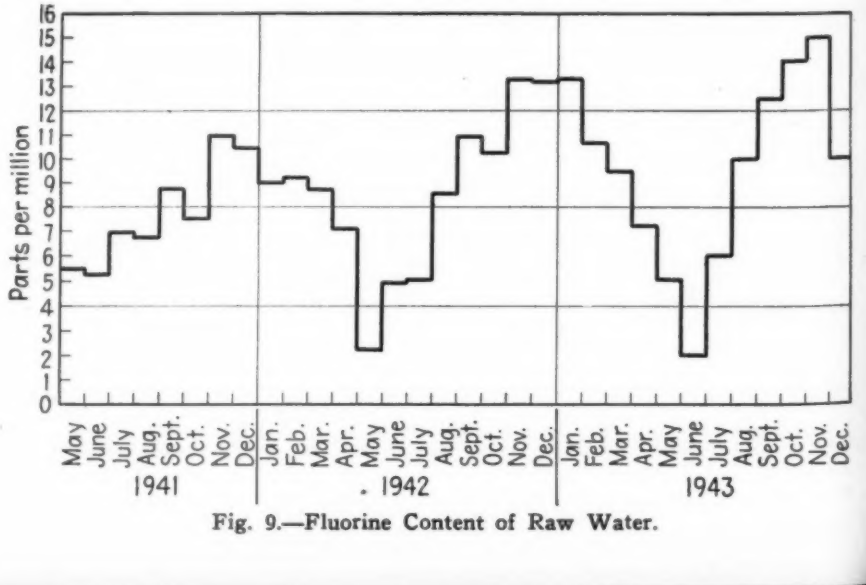

Fig. 9.—Fluorine Content of Raw Water.

OPERATION OF SMALL FILTRATION PLANTS

I. Laboratory Control

(The First of a Series of Articles)

By A. E. CLARK
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NASHVILLE SUBURBAN
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IT HAS been most interesting to watch the advance which has occurred during the past 35 years in the stress put on laboratory control in water purification plants. The development of technical control has now progressed to the point where even the smallest plants have some means of checking the operation and results through the use of technical methods. A great deal of credit should be given to the state departments of health through sanitary engineering divisions and the water works associations for this progress. The technical journals have played a part in publishing material contributed by many writers on the use and importance of technical methods in plant control.

In order that there might be some uniformity and recognized methods used in the recommended tests, both chemical and bacteriological, the American Public Health Association compiled and published Standard Methods of Water Analysis in 1905. Since the first publication of that manual succeeding editions have been issued jointly by the A. P. H. A. and the A. W. W. A. Each edition has made changes in methods as well as additions to keep abreast of the advance in technical methods for the control of water works. *The 9th edition of Standard Methods for the Examination of Water and Sewage* was published in December, 1946.

Important Control Tests

Thirty-five years ago very few of the smaller plants had laboratory facilities or supervisors capable of using them. Coagulation depended on a visual check of the floc; sometimes it worked, sometimes it did not. To make coagulation work, valiant efforts were made, usually by adding more alum or other coagulant. In many cases such additions of coagulant were actually detrimental to the coagulation and settling. Not many plants had premixing and this lack served to increase the difficulties. The introduction of the jar test for determining the proper coagulant dosage proved of great benefit to the small plant operator and the adoption of pre-mixing further reduced the errors in coagulant dosage. The jar test properly used is a relatively simple procedure and practically all plants use it.

The Author

Following the 1912 experiments on liquid chlorine for disinfection of water supplies, the use of hypochlorite for this purpose was displaced by the former and the use of liquid chlorine advanced rapidly. The development of the ortho-tolidine test gave to water plants a simple and rapid method of checking residual chlorine in the finished water. Certain substances interfere with this test, but on the average water supply the simple method is satisfactory. The availability of this test to the small plant operator proved most important in producing a bacteriologically safe water. Many State Departments of Health furnished without cost color standards, ortho-tolidine solution and instructions for the use of this test.

The above two tests intelligently used on most waters provide the small plant operator with sufficient information to produce a reasonably satisfactory water. There are, however, many other factors such as iron, high free CO_2, taste and odor, hardness, color, low or high pH, trade wastes, etc., which enter into the production of a safe and satisfactory water and with which the operator is unable to cope without additional knowledge and equipment.

Short Schools

In order to provide the small plant operators with the knowledge and information to handle some of his problems, the Short School was started. These short schools are generally sponsored by the state departments of health and usually in cooperation with the state universities, which provide class room and laboratory facilities sufficiently large to adequately accommodate those attending. The short school has proved most successful and has been the means of providing the small plant operator, as well as operators of the larger plants, with most useful information.

The teaching staff of the universities, outside speakers and the staff of the health departments are always available at the short school. Insofar as possible, the material is given in non-technical or understandable language so that the small plant operators without a basic technical background can gain considerable knowledge of methods. Laboratory technic is taught in the same manner, by example, followed by the operator making the tests himself under the supervision of a member of the teaching staff. These schools usually last from three to five days and are held once each year.

The short school has probably done more than any other thing to help the small plant operator in promoting his interest and in giving him the knowledge to produce a satisfactory water. Short schools do not confine themselves to laboratory controls, but cover the whole range of plant operations. Without knowledge of the proper use of available equipment, laboratory controls serve only part of their purpose. A recent issue of *Water and Sewage Works* shows a class in chlorinator maintenance. This class was under the supervision of a manufacturer's representative who taught the disassembling and assembling of the chlorinators. This is one more step and a most important one in familiarizing the oper-

ator with his equipment. Every operator should take advantage of the short school held in his state. If there is no short school, operators should contact the State Department of Health and request that one be started.

Laboratory Control Tests

If the officials of a water department or company show enough interest to have operators attend short schools they will probably be willing to purchase the apparatus and materials required for the recommended tests.

When purchasing laboratory equipment and materials, the advice of the state health department engineer should be followed, since he is usually the one who recommends the scope of the laboratory work to be undertaken in the small plants. Recommended lists of apparatus and materials are sometimes furnished by the state health department, listing the various supply houses from which purchases may be made.

If the general control tests, chemical and physical, only are made, the expense can be held to a nominal cost. A great deal depends on the type of equipment purchased. On the other hand, if complete laboratory work, including bacteriological examination, is contemplated, then the cost will increase quite considerably due to the additional apparatus and glassware required.

After attending the short school and possibly with some further help from the health department engineer on the ground, the small plant operator should not encounter any great difficulty in making the recommended tests. The operator can purchase books, devoted to laboratory work, written especially for the non-technical operator and he will find that gaining facility in using the pipettes, burettes, etc., is a matter of time and continued use of them. The operator should follow all precautions pointed out to him in order to promote accuracy and to obtain dependable and comparable results.

The apparatus purchased should be the simplest compatible with accurate results. All standard solutions can be purchased and extreme care must be used to prevent a change in any of them, such as dilution or contamination with another solution, etc. If bacteriological examinations are to be made, extreme care must be practiced in using only sterile glassware, as well as sterile culture media. Dehydrated media can be purchased and bacteriological culture media can easily be prepared by adding the proper amount of distilled water to a weighed quantity of the media, heating, tubing and sterilizing under pressure.

The object of making the various tests and examinations is to control plant operation. For example, the jar test gives the information required for the coagulant dosage, the ortho-tolidine test indicates the required chlorine dosage to maintain a certain residual chlorine in the finished water. The turbidity and color tests show the removal of each, and depending on the results, indicate the need for a change in the coagulant dosage or change in coagulant for, say, color removal. Taste and odor determinations may indicate algae growths, which would further inform the operator that he should be prepared to take steps to eliminate them. The pH tests of the raw and coagulated waters serve as a quick check on the coagulant dosage and the pH of the finished water is important when the addition of lime or soda ash is used for its control.

Each of the recommended tests has a definite bearing on plant control and they should not become mere routine. Even though day after day the results are apparently about the same, the operator should always be vigilant and at the first indication of a change make every effort to account for it. It may be due to the solutions used in making the tests or an error on the part of the operator or a definite change in the water. All must be checked and the reason for the change determined.

The operator who is interested in producing a water that will comply with present day standards derives a great deal of satisfaction in the laboratory work, applying it to plant control to meet and solve the many problems which arise in the operation of a water treatment plant.

ALABAMA WATER AND SEWAGE WORKS ASSN. COMPLETES ORGANIZATION

Second Short School Held at Tuscaloosa

(L. to R.)—Prof. Gilbert H. Dunstan, Assoc. Prof. of San Engr. at the University of Alabama, Treasurer; Prof. Alex O. Taylor, Director, Engineering Extension Service, Alabama Polytechnic Institute, Secretary; W. H. H. Putnam, Asst. Mgr. Birmingham Waterworks Co., President; Tom Collins, Manager of the Ozark waterworks, Vice-President, and Charles White, Engineer, Alabama State Board of Health, Montgomery, Editor.

More than 100 operators and engineers registered for the Second Annual Short Course Conference of the Alabama Water and Sewage Works Assn. The meeting was held at Tuscaloosa, Ala., from June 12-14 in cooperation with the Alabama State Dept. of Public Health, The Alabama Polytechnic Institute, and the University of Alabama.

The business session featured the adoption of a constitution and by laws and the election of officers shown in the accompanying photograph. The technical program included lectures on the Fundamentals of Chemistry, Well Supplies, Chemical Control Tests, Filtration Problems and Practices, Chlorination, Stream Pollution, Water and Sewage Bacteriology, and Sewage Testing.

At the final session, W. H. Nicol, City Commissioner of Tuscaloosa, in charge of the water works department, reviewed the growth and expansion of the system in the city, and afterwards the group visited the Tuscaloosa Filtration Plant.

N.Y. AND N.E. SEWAGE WORKS ASSOCIATIONS' JOINT SPRING MEETING

Two-Day Albany Meeting Is Third Joint Convention

MEETING in Albany, the capital city of the Empire State, the N. Y. State Sewage Works Assn. and the New England Sewage Works Assn. held their third joint meeting. The two-day meeting drew a registration of 303 (102 from New England and 201 from New York), not including the ladies.

Presidents

New York
Alex. G. Martin
Commissioner
Town of
Tonawanda, N. Y.

New England
Thos. R. Camp
Consulting Engr.
Boston,
Mass.

In addition to two luncheons and a dinner, the entertainment included the "House of Magic," with the compliments of the General Electric Co. of Schenectady, N. Y. There were a number of manufacturers' exhibits and four technical sessions.

The program was prepared by the respective program chairmen of the two organizations, **Sherman E. Chase,** Partner, Metcalf & Eddy, consulting engineers of Boston, for the New England Association, and **John W. Johnson,** Superintendent, Buffalo Sewer Authority, Buffalo, N. Y., for the New York Association.

Vice-Presidents

New England
L. W. Van Kleeck
Engr.
State Dept. Health
Hartford, Conn.

New York
E. C. McKeeman
Supt.
Treatment Wks.
Freeport, L. I.

Awards

As is customary at the spring meeting of the N. Y. Association, awards were given for the best annual report. Known as the Rating Award and presented by **William D. Denise,** Chairman of the Rating Award Committee, the award cup was presented to **John W. Eagleson,** operator of the Great Neck, L. I., plant.

The N. Y. Association also presents a certificate for the best report submitted by a previous winner of the Rating Award. This year that certificate went to **William Edwards,** Supt., Gowanda State Hospital sewage treatment plant, Gowanda, N. Y.

On behalf of the Federation of Sewage Works Associations, **Francis S. Friel,** Pres., presented the George B. Gascoigne Award for 1945 for the best operating paper to **John McDonald,** Supt. of the Springfield, Mass., plant. The award was for Mr. McDonald's paper published in the Sept. 1944 Sew. Wks. Jour. titled "Sludge Disposal Experiences at Springfield." Mr. McDonald was in the service in the Far East at the time the award was made and had only recently returned to receive it.

Federation President
Francis S. Friel
President
Albright & Friel Engrs.
Philadelphia, Pa.

Mr. Friel also announced that the Kenneth Allen Award of the New England Sewage Works Assn. for 1947 was to be presented to **Stuart Coburn,** who was a moving spirit in the formation of the New England Association in 1929, was president for the first two years of its organization, and since then has been chairman of the Membership Committee.

Mr. Friel also announced that **Wellington Donaldson** of New York City has been chosen by the New York State Sewage Works Assn. to receive the Kenneth Allen Award for 1947 for that association.

Secretaries

New York
A. F. Dappert
Engineer
State Dept. Health
Albany, N. Y.

New England
W. E. Merrill
Engineer
State Dept. Health
Boston, Mass.

This Kenneth Allen Award of the Federation is for services rendered to the individual association and should not be confused with the Kenneth Allen Memorial Research Award given annually by the New York State Sewage Works Assn. for the best paper of a research and engineering nature prepared and presented by a member of the N. Y. State Sewage Works Assn.

A Kenneth Allen Memorial Award Plaque of the N.Y.S.S.W.A. was presented by A. F. Dappert, secretary of the association, to **Thomas M. Riddick,** consulting engineer and chemist of New York City, and **H. O. Johnson,** Supt., Belgrave Sewer District, Great Neck, L. I. This paper was announced as the recipient of the award at the Jan-

Program Chairmen

New England
E. S. Chase
Cons. Engr.
Metcalf & Eddy
Boston, Mass.

New York
J. W. Johnson
Supt.
Treatment Wks.
Buffalo, N. Y.

uary meeting of N.Y.S.S.W.A. and was titled "Solids Removal as Affected by Plant Design."

Current Developments

At the luncheon held on the first day of the meeting, the membership of the two organizations was welcomed by the **Hon. Erastus Corning, II,** Mayor of the city of Albany. Mayor Corning pointed out that Albany planned to spend $10,000,000 within the next 15 years to complete the sanitary system and sewage treatment works. Although this is the biggest single capital investment to be made by the city of Albany, Mayor Corning stated that probably 90 per cent of the population would not know about it, and he emphasized the need for public relations to acquaint the citizenry with the problems, operation, and cost of providing proper sewage treatment.

The luncheon was also addressed by **Francis S. Friel,** consulting engineer of Philadelphia, Pa., and president of the Federation of Sewage Works Assns. Mr. Friel spoke on "Current Developments in Sewage and Industrial Waste Treatment." and pointed out that there is a distinct need for better criteria for design. We should be more exacting now, and the fact that much research today is toward the study of unit loading indicates that we are more exacting.

Mr. Friel emphasized the need for good operating reports not only as a means of keeping track of what is happening in a sewage works for the benefit of the operator, but also of letting the public know what is happening at that same plant.

In the matter of laboratory technic and methods, the Federation has obtained a $38,000 grant for special research on laboratory methods, but this money is not available as Congress has not yet made the appropriation. This research will be guided by Dr. W. D. Hatfield of the Committee on Standard Methods.

In current trends, Mr. Friel has noted a tendency to use unorthodox methods to handle overloads. These include recirculation, modified sewage aeration as practiced at New York City, control of activated sludge bulking by addition of digested sludge as at Peoria, plain aeration as practiced by Mann at Syracuse, and the addition of raw sludge to aid the settling of solids as practiced at Denver.

Mr. Friel also notes advancement in equipment. There are new developments toward eliminating old problems, particularly with reference to heating sludge digesters, the use of dual fuel engines, new types of air diffusion, sludge drying, metering, sewer cleaning and maintenance. The patent situation on a number of matters concerned with sewage treatment still remains confused.

In reference to industrial waste treatment, current practice indicates separation and treatment at the industry by use of screen, grease removal equipment, or flocculation, thereby reducing the load so that the waste can be discharged to the city sewers and treated in the city sewage plant. There is also a tendency toward the overhauling of processes to accomplish recovery, including by-product recovery or recovery of cooling

Arrangements Chairmen

F. W. Gilcreas
Chemist
State Dept. Health
Albany, N. Y.

C. C. Agar
Engr.
State Dept. Health
Albany, N. Y.

waters. Actual treatment and disposal of waste by industry itself is becoming more popular. Mr. Friel believes that stream pollution control is necessary to make industry give the processes the control that is needed, that the number of waste treatment plants in this country is not a gage of the pollution load. Whether biological treatment or chemical treatment is used for industrial waste treatment is a matter that depends entirely on the type of material. So important is this matter of industrial waste treatment that Mr. Friel believes that the Federation will consider the setting up of an industrial waste section within its organization at the meeting this coming summer.

As to the current trends in construction, Mr. Friel pointed out that new work is being priced out of the market. The missing link in the whole program of pollution abatement and stream pollution control is construction, sufficient construction, that is, to take care of the necessary work needed. At the present time new construction is moving downward because of the high cost, and while this trend may be corrected within six months, it is to be expected that future construction costs will be 50 per cent or more higher than in 1939. At the same time the cost of bonds is down.

Mr. Friel concluded his talk with a review of Federation activities, its growth, the importance of the organization and its services, and the caliber of the meeting, and he mentioned the annual convention of the Federation to be held in San Francisco this year in conjunction with the American Water Works Association.

Korea

Under the presiding gavel of **Alexander G. Martin,** Town Councilman and Director of Public Works, Town of Tonawanda, N. Y., and President of N.Y.S.S.W.A., the first technical session was introduced with a paper by **John B. McDonald,** Sewage Treatment Plant Engineer, Springfield, Mass. Mr. McDonald's topic was "Water Supply and Sewage Disposal in Korea."

With little ground water in Korea, few rivers, few dams, and small valleys, the problem of water supply is a difficult one. Such water supply filtration plants as do exist have well equipped laboratories, utilize alum for coagulation, and for the most part have Wheeler filter bottoms. In spite of good laboratory control equipment, the alum is often dosed by hanging bags or wicker baskets in the channel to the coagulating basin, and dosage is changed by varying the number of baskets so hung. Frequently operators are unacquainted with the proper technic of control, and if the water supply appears to be worse they simply double the dosage of alum or cut it in half, as the case may be.

There are public water faucets in most of the cities and laundry is generally washed in the street gutters. In one or two instances infiltration galleries have been constructed, and one city actually pumps its water for a distance of 24 miles.

There is little modern sewage treatment in Korea. Night soil is an important commodity and is a big business, being removed to farms about the community. Usually the "day's take" is collected in a wagon and is hauled to the farm, where it is dumped into a cistern or a digester. From this digester the supernatant liquor is ladled out in buckets and is distributed to the

Programmers

W. J. Scott, Chief Engr., State Dept. Health, Hartford, Conn.

S. E. Coburn, Chem. Engr., Metcalf & Eddy, Boston, Mass.

Harry Fitts, Maint. Engr., Queens Sewers, N. Y. City

W. S. Holton, Asst. Sales Mgr., Fiber Conduit Co., Orangeburg, N. Y.

J. D. McDonald, Supt., Treatment Wks., Springfield, Mass.

T. R. Komline, Pres., Komline & Sanderson, Ridgewood, N. J.

growing plants by a hand ladling process using a gourd.

There is one large sewage treatment plant for a population of 300,000 but the sewage is collected by a house to house canvas and is carted to the treatment works. From there the farmers take what they wish and the remainder goes to four-stage digestion tanks. The effluent sludge and liquor from the final digestion compartment is pumped four miles through a 12 in. line to a drying bed. The sludge in this drying bed is also used by nearby farmers.

In spite of the rather crude disposal of sanitary wastes, there is little typhoid fever and very little amoebic dysentery although there is some cholera in the country.

Roto-Louvre Dryer

"Sludge Drying with Roto-Louvre Dryers" is a process offered by the Dryer Division of the Link-Belt Co., and was described by **Morton Goldstein,** Eastern Manager of that division, Philadelphia, Pa.

Mr. Goldstein pointed out that in the matter of sludge drying the first step was usually mechanical removal of water in which step it was desired to remove as much water as possible. Vacuum filters at present are the most effective, reducing the water content to 75 or 85 per cent. From this wet sludge cake the moisture can best be removed by heat drying, depending upon three methods of heat transfer—that is by conduction, by radiation, and by convection. In most dryers, both conduction and radiation account for but a small part of the heat transfer. Flash dryers, spray dryers, and tunnel rotary dryers depend largely on convection for the transfer of heat.

Mr. Goldstein showed slides of the Roto-Louvre design which has an internal shell sloping of overlapping louvres, through which the hot air is blown and on which the drying sludge moves. Actually the material flows on itself and there is no erosion of metal and thereby less attrition and less dust produced. The particles do not rest on the metal but rest on the bed of air maintained by the positive pressure. The design can use any source of heat.

Experiments at Chicago led to the installation of a Roto-Louvre dryer at Milwaukee. There the equipment handles 11,875 lb. of wet sludge (84 per cent moisture) per hour; or it evaporates 9,875 lb. of water per hour, producing 2,000 lb. of sludge with 5 per cent moisture. Approximately 50 per cent of the dried sludge is recirculated in order to reduce the concentration of the moisture in the incoming sludge to approximately 50 per cent. This prevents balling of the wet sludge during the drying process. The Milwaukee dryer is 11 ft. 4 in. in diameter and 35 ft. long, and operates at a temperature of 750 deg. F.

The size of the particles of dried sludge depends on the amount of dried sludge returned to mix with the incoming wet cake. At Milwaukee most of the material is between 10 and 48 mesh. Operation has been quite satisfactory and no odors have been observed as long as the material itself remains at a temperature below 150 deg.

Spray Drying

"Experiences in the Thickening and Drying of Sludge" was the title of a paper presented by **Thomas R. Komline,** President, Komline-Sanderson Corp., Ridgewood, N. J. Mr. Komline reviewed the experiences in drying liquid sludge at Plainfield, N. J. (See *Water & Sewage Works,* p. 323, Aug. 1946.) Eight years of experience with this type of dryer at Plainfield, N. J., has shown that sludge thickened to 12 to 15 per cent solids could be sprayed-dried to a moisture content of 15 per cent. The sludge is thickened by alum treatment and flotation and the total cost of operation is $12.15 per ton.

The next step in drying as attacked by Mr. Komline's company was to determine the possibility of

Award Winners and Programmers

Wm. L. Edwards, Plant Operator, Gowanda State Hospital, N. Y., Twice Winner of Report Rating Award (1945 & 1947), Receives Trophy from W. D. Denise (Rochester), Chmn. of the Rating Com.

Joseph Doman, Engr. in Chg. Sewage Disposal, Greenwich, Conn.

Morton Goldstein, Eastern Mgr. Dryer Div. Link-Belt Co. Philadelphia

A. J. Maahs, Engr., Transite Pipe Div., Johns-Manville Corp. New York

John W. Eagleson, Plant Operator, Great Neck, L. I., Receiving for His Plant the Report Rating Award Trophy for 1946 from W. D. Denise, Chairman of the Rating Committee.

spray drying filter cake. Filtration was accomplished by the use of a cord filter which was quite successful after troubles caused by foaming and solids in the aligning rollers was eliminated. Using 5 to 6 per cent ferric chloride, the filter produced 7 lb. per sq. ft. per hour of sludge with less than 72 per cent moisture.

Having solved the filtration problem, the problem of atomizing solid sludge next required study. That, together with a simplification of the system of air evacuation and an analysis of a thermal cycle and the development of constants for the equipment, constituted the research attack on the operation of this type of unit on filter cake sludge.

It was observed that the peripheral speed of the atomizing unit was important; 3,500 rpm., which required a 15 hp. motor, gave the best result. At this speed the dryer, which is 23 ft. in diameter, 24 ft. deep, and operates at 900 deg. F., will reduce 1,000 lb. per hour of wet sludge cake containing 72 per cent moisture to a sludge containing 12.5 per cent moisture; 8,500 cu. ft. of air per minute are required and the air which enters at 900 deg. F. leaves the system at 250 deg. F.

Estimating labor costs at $1.00 an hour, power at 75 cents, fuel at $4.70, and maintenance at 10 cents per hour, the cost of operation is $6.55 per thousand lb. per hour, or $13.10 per dry ton.

If the sludge is burned, then the fuel costs are eliminated, power costs are increased slightly, and maintenance costs go up 20 per cent or 2 cents per hour. The cost of operation per thousand lb. for burning sludge is $4.24 or $8.48 per dry ton.

As a result of these experiments it was proved that spray drying could be applied to a variety of sludges, including sludge filter cakes, and that the cord filter gave a uniform output with long life of cord.

Industrial Wastes

In the absence of **Almon L. Fales,** Partner, Metcalf & Eddy, Engineers, Boston, his paper on "Industrial Wastes" was presented by **Stuart Coburn,** Chemist, Metcalf & Eddy. This paper dealt with the problem of metal wastes from the plating of airplane parts. These wastes contained sodium cyanide, lead and chromic acid, and were too strong to discharge direct to streams. Most of the rinse waters were weak, but some contained acid, lead, and chromium.

There are two methods of approach to the treatment of these wastes. The first is to get the hexavalent chromium into the trivalent form. For this, ferrous sulfate and lime were used, the ferrous sulfate being used to reduce the cyanide. This method, however, leaves iron, which must be removed with the lime and this presents a problem of sludge. The second method of reducing the chromium is to use sulfur dioxide, which eliminates the sludge problem.

Two methods of handling the waste were possible. The first was storage of the combined wastes and uniform discharge through one shift with chemical treatment for 24 hours, or the separation and collection of standing baths and the treatment of those baths. This appeared to be the less expensive operation and was employed.

Rating Award Chairman
Wm. D. Denise
Supt.
Treatment Wks.
Rochester, N. Y.

Luncheon Speaker
Geo. E. (Doc) Symons
Assoc. Editor
Water & Sew. Wks.
New York

In commenting on this paper, **William S. Wise,** Chief Engr., State Water Commission, Hartford, Conn., said that this idea had set a pattern for industrial waste treatment, namely, that the solution of the problem should be tailor-made for the particular plant to fit the conditions of concentration of waste and availability of dilution for disposal.

Stream Pollution Control

"Federal and State Legislation for Stream Pollution Control" is a very live topic of today and was discussed at length by **Warren J. Scott,** Chief Engineer, State Dept. of Health, Hartford, Conn. Mr. Scott, who has served as a representative for both the New England Sewage Works Assn. and the New England Water Works Assn. in consideration of proposed Federal stream pollution legislation, is thoroughly acquainted with the subject and presented a comprehensive statement of the current situation.

At the present time there are ten states in which stream pollution control is vested in the state department of health only. Eleven states have an agency separate from the health department but closely allied to it with technical service furnished by the state department of health, and a representative of the health department serving as a member of the separate agency. Seventeen states have stream pollution control vested in the state department of health and other agencies, four states have a water pollution control board separate from the department of health, while six states have no state agency dealing with the problem.

Inasmuch as the statement has been frequently made that the state department of health alone cannot solve the stream pollution problem because of the numerous other interests involved (boating, fishing, industrial use, etc.), Mr. Scott believes that there is much to be said for the establishment of state boards on which state health departments, industries, agencies acting for fisheries and conservation, and possibly other groups or interests may be represented, with technical service being furnished by the state health department, which must maintain a staff of sanitary engineers to deal with problems of water supply and other sanitary engineering phases of the problem. Mr. Scott further believes that separate technical organizations are likely to be more expensive and that there is likely to be some duplication.

That stream pollution is not wholly the problem of one state, but is often a problem of a region, is very evident and there is increasing interest today in interstate negotiations leading to interstate informal agreements or formal compacts to control pollution of waters common to two or more states. As examples of these interstate organizations, Mr. Scott cited the Great Lakes Drainage Basin and the Upper Mississippi River Basin sanitation agreement; Incodel, the agency interested in water conservation and water pollution problems in the Delaware River Basin (including Delaware, New Jersey, New York, and Pennsylvania); the Interstate Sanitation Commission of New York, New Jersey, and Connecticut, having jurisdiction over shore waters adjacent to metropolitan New York; and the Ohio River Compact, not yet in operation.

In addition there is now in formation the somewhat different type of

Some of the Ladies Attending

Mrs. Carl Bernhardt (Jamestown, N. Y.)
Mrs. Morris Cohn (Schenectady, N. Y.)
Mrs. Charles Lose (Morristown, N. J.)
Mrs. Walter Merrill (Boston, Mass.)
Mrs. William Petrie (Norwalk, Conn.)
Mrs. Sherman Chase (Boston, Mass.)
Mrs. E. B. Cobb (Needham, Mass.)
Mrs. Paul Hiller (New York)
Mrs. Charles Agar (Albany, N. Y.)
Mrs. Guy Griffin (Cambridge, Mass.)
Mrs. Henry Rath (Jackson Heights, L. I.)
Mrs. Stuart Coburn (Boston, Mass.)

compact for the New England states. The idea for this compact rests on the fact that New England is a region with many similar characteristics, natural resources and interests, and numerous streams flowing across state borders. The New England state sanitary engineers have agreed that the states should band together to solve their pollution problems. They are convinced that this solution by cooperative action is far preferable to federal control, even though a receptive attitude is maintained towards federal advice or stimulation in connection with national stream pollution abatement.

This particular compact has some interesting features, including the following: (1) It applies to interstate streams, ponds, lakes, tributaries and tidal waters ebbing and flowing past the boundaries of two states; (2) There will be five commissioners from each state; (3) There will be a secretary and clerical staff but no provision for an engineering staff. Technical experts from each state are authorized to confer; (4) The Commission will establish reasonable physical, chemical, and bacteriological standards of water quality for the various classifications; (5) Each state pledges to provide abatement of existing pollution and control of future pollution; (6) Action by the commission must be approved by a majority of the commissioners of each state; (7) Maximum appropriations are prorated mainly on the basis of population; (8) The commission has no power to issue orders; (9) The compact becomes effective when approved by any two contiguous states; (10) Provision is made for New York State to join the compact if it so desires, but the area of the Interstate Sanitation District is excluded.

Mr. Scott stated that "it is believed that this compact and the establishment of a compact commission will be a strong motivating force to bring about the clearing up of the interstate streams in New England to the degree warranted by their present and future proposed use."

Mr. Scott devoted the last half of his paper to the subject of federal legislation and reviewed the history of pollution abatement bills before Congress. He also told of the meetings of the state sanitary engineers in New York in November, 1946, at which time agreement was reached on the type of federal legislation. This agreement resulted in the introduction of the present bills in Congress S-418 and HR-315 and HR-470. These bills are very similar to HR-4070 of the 79th Congress but have some additional provisions. In addition to these bills, Congressman Mundt introduced HR-123 which is similar to S-418 and its companion bills except in two respects. The first is the provision that after the enactment of the act, no new source of pollution shall be permitted without the approval of the State Health Authority and the Surgeon General. The second difference is that if the Water Pollution Advisory Board finds it impossible or impracticable for a municipality or industry to provide adequate treatment because of financial inability, then there shall be no court action for a period up to five years.

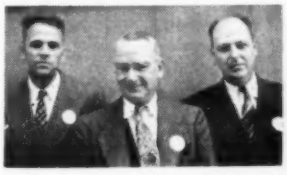
Mr. Scott also mentioned two other bills introduced at the 80th session of Congress, S-244 and HR-1047, which encourage the prevention of stream pollution by industrial wastes by allowing the cost of treatment of industrial waste to be deducted in computing income tax by the industry.

Mr. Scott concluded his paper with the observation that while the pollution problem had unquestionably grown beyond state borders, this fact alone did not make federal pollution control necessary as it had been shown that states could join together for a unified water pollution control program. Perhaps the principal service the Federal government could make would be to promote, coordinate, and even carry out research in the field of sewage and industrial waste treatment, particularly the latter. As matters now stand, slowness on the part of some states to accept the responsibilities in the field of water pollution may hasten the federal legislation, but if all states will awaken to their problems and take action, the Federal government will then need only to act as a coordinating agent. And while it cannot be hoped that all streams will be restored to the state of pristine purity, certainly in the light of known scientific advances today waters can be improved and reckless and unwarranted pollution of our water resources should be controlled.

Pollution Abatement in N. Y. State

Morris M. Cohn, Sanitary Engineer, Schenectady, N. Y., and consultant to the special committee on stream pollution abatement of the New York State legislature's Joint Legislative Committee on Interstate Cooperation, reviewed the work of that committee in its effort to set up legislative control of "pollution abatement in New York State." In presenting his paper, Mr. Cohen abstracted the report of the committee which he, as consultant, had helped to author.

The 1946 session of the New York State Legislature directed the Joint Legislative Committee on Interstate Cooperation to create a special committee on pollution abatement. In



Three of The Delegation from Springfield, Mass.
Joseph Fitzgerald, Supt. Sludge Disposal
George M. Granger, Deputy Supt. of Sewers
Richard E. Dudley, Deputy City Engineer

At the Closing Luncheon
("Doc" Symons Speaking)

Four of the Delegation from Greenwich, Conn.
Ben Lyon, Operator, East Rochester Plant
Russell Raymond, Operator, Cos-Cob Plant
Fred Muldoon, Operator, Old Greenwich Plant
Joe Blackett, Operator, Grass Island Plant

March this special committee filed a report of its exhaustive studies.

This progress report calls for further study of the problem of pollution, but makes an interim recommendation that the state grant aid to the extent of two per cent of estimated construction costs, on a matching basis, to local units of government for planning sewers and sewage treatment works.

The report further stated that waterborne pollution in New York State presents a growing menance to public health, recreation, fish and shellfish life, realty values, and industrial development.

During the course of the study the special committee on pollution abatement held conferences in various regions in which representatives of 37 counties participated. It was found that in each area there are stream pollution problems of greater or less degree caused by the discharge of untreated or inadequately treated sewage or industrial wastes.

Other findings of the committee as summarized include the fact that municipal officials are generally cognizant of the undesirability of discharging wastes into local streams, and that industrial officials, too, appear to recognize the detrimental effects on surface waters caused by the discharge of wastes.

The committee also developed the information that the public is alert to the dangers of stream pollution and wants to do something about it, as evidenced by representatives of conservation groups, fish and game clubs, women's associations, garden clubs, veterans' bodies and similar civic-minded organizations which expressed concern and dissatisfaction over the increasing menace of pollution.

The committee further points out in its report that present legal machinery for dealing with pollution problems is in need of overhauling and strengthening and the committee plans to give further attention to the drafting of new and more effective legislation.

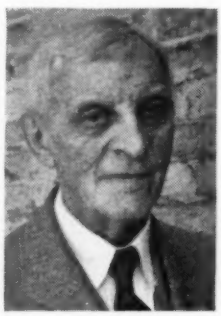
Inasmuch as recurrent proposals in Congress during the past years for a Federal pollution abatement program have failed to become law, the committee believes that the way to preserve the control of the states and localities over their own waterways is for the states, through their local units of government and industries, to assume their own pollution abatement responsibilities, rather than to await Federal government action.

As a result of this committee study and report, a bill was passed and signed by Governor Dewey to the effect that state planning aid will be available to sewer systems and sewage treatment processes. Under the terms of the act, the state will extend aid up to half the cost of plans for sewers and sewage treatment projects, but the maximum aid is set at not more than two per cent of the estimated construction cost of such projects.

N. L. Nussbaumer
Nussbaumer & Clarke, Engrs.
Buffalo, N. Y.

Guy E. Griffin
Sanitary Engr.
(On Terminal Lv.)
Cambridge, Mass.

Richard Hazen
Malcolm Pirnie
Engrs.
New York



Chas. A. Emerson
Havens & Emerson
Engrs.
New York

Thos. A. Berrigan
Chief Engr.
Metr. Sewer Distr.
Boston, Mass.

John J. Baffa
Consulting
Sanitary Engr.
New York

Digestion Tank Maintenance

Under the leadership of **Joseph Doman,** Sanitary Engineer, Div. of Highways and Sewers of Greenwich, Conn., the problems of digestion tank maintenance were discussed by various members of the audience. William E. Edwards, Sup't of Sewage Treatment, Gowanda State Hospital, told of the experiences using lime in his digesters and the benefits observed. George E. (Doc) Symons, Associate Editor, *Water & Sewage Works,* reported that Buswell and Schlenz had stated at the meeting of the Ohio Sewage Conference last year that lime had no place in the operation of digestion tanks, while Dr. Willem Rudolfs, at the N. J. Association meeting in Trenton this year, stated that lime might not be necessary in the mid-west where the alkalinity of the sewage was high, but it did have a place in the eastern waters where the alkalinity is relatively low.

Mr. Fitzgerald of Hudson Falls, N. Y., discussed the problems of scum in his digester and explained how they had pumped it off with plunger pumps and were now eliminating the scum problem by keeping it pumped away.

John W. Johnson, Sup't. of Sewage Works, Buffalo, N. Y., explained the system of timing the pumping and withdrawal to improve operation of digestion tanks, and the problems involved in heavy scum which actually pushed gas pipes and heating coils out of line. Buffalo is now considering the installation of an external heating unit.

Paul Bardett, Sup't. of Sewage Treatment at the 26th Ward Plant in New York City, reviewed his experiences with pumping the scum down to the raw sludge line so that the scum was seeded regularly with incoming sludge.

Sewer Maintenance

Most cities do not have the "Sewer Maintenance Problems" experienced in the Borough of Queens, N.Y., but the discussion of those problems by **Harry Fitts,** Engineer of the Sewer Maintenance Bureau in Queens, was of interest to many operators of sewage plants. Part of the difficulty in Queens arises from a too rapid growth of the city, low lying sandy ground subject to tidewater in many instances, and lack of proper foresight by the designer in providing storm and sanitary sewers for housing developments.

Queens, which is twice as large as Boston and has three times its area, has 1250 miles of sewers of which two-thirds are combined. According to Mr. Fitts, separate sewer systems involve more maintenance problems than do combined systems, and he argued not only for more combined systems, but also for pro-

Paul Molitor, Supt.
Sewage Treatment
Rutherford, N. Y.

Jim Ferris, Distr. Mgr.
Electro-Bleaching Gas Co.
New York

Paul Hiller, Sales Engr.
Innis Speiden Co.
New York

F. B. Atherton
Asst. City Engr.
Rutland, Vt.

L. J. Tierney
Chicago Pump Co.
Boston

M. T. MacLellan
Chicago Pump Co.
Greenfield, Mass.

W. A. McMahon
Supt. of Sewerage
Torrington, Conn.

John R. Szymanski
Supt. Treatment Works
New Britain, Conn.

John D. McDonald
Supt. Treatment Works
Springfield, Mass.

"Bill" Fenger, Distr. Mgr.
Mathieson Alkali Works
Hamburg, N. Y.

"Johnnie" Johnson
Supt. Treatment Works
Buffalo, N. Y.

George Fynn, Ch. Chem.
Sewage Treatment Works
Buffalo, N. Y.

vision of proper cleanouts and bulkheads with manholes at reasonable distances apart.

During the discussion of this paper, John W. Johnson of Buffalo suggested a portable contractor's elevator for use in the large shafts (70 ft. deep or more) where iron manhole steps had not proved satisfactory. Morris Cohn of Schenectady, N.Y., pointed out that groundwater infiltration in sewage development often overloaded sanitary sewers in suburban areas. Thomas Camp, Consulting Engineer of Boston, and Thomas Berrigan, Directing Chief Engineer of the Metropolitan Sewer System of Boston, both argued against combined systems, as the use of combined systems is the cause of most of the trouble. Mr. Camp further pointed out that it was uneconomical to build a sewer for greater than a peak dry weather flow.

Transite Pipe

"The Use of Transite Pipe" was presented by **A. J. Maahs,** Engineer, Transite Pipe Dept., Johns Manville Sales Corp., N.Y. Mr. Maahs described the chemical and physical properties of the cement asbestos pipe and its uses. He explained how it was formed and cured, why it is so dense (specific gravity 1.8), and the uses to which it could be put.

In addition to showing slides of typical installations in both water and sewer lines, Mr. Maahs told of one installation where the pipe is used for acid mine water containing 11,000 ppm. of acid of which 4600 ppm. is free sulfuric acid. Transite pipe has a crushing strength to meet any specification, is root proof, and is joined by sleeve joints which are sealed with an asphalt compound. The company also furnishes lateral house connections which may be obtained either in straight lengths or in bends and are attached to the main sewer by a cast iron bolted connection.

Root Proof Pipe

In the absence of Robert D. Ellis, Research Engineer of the Fibre Conduit Co., Orangeburg, N. Y., his paper on "Orangeburg—the Root Proof Pipe" was presented by **W. S. Holton** of that company. This asphalt impregnated fibre pipe has quite a long history, mostly in the past for electrical conduits. In 1930 it was developed as a sewer pipe and later perforated to use as a land drain and for septic tank effluents. It has a tapered joint which can be cut in the field and a collar which can be made absolutely tight by driving. It can be deflected slightly and by proper laying and back-filling, the load can be distributed around the pipe by the soil. The pipe consists of 74 per cent pitch (bitumen with a high melting point) and 26 per cent cellulose fibre. When completed it has a high C value ($C = 140$) and it may be obtained with a complete line of adapters, bends, etc. in 4, 5, 6, and 8 in. diameters. It is not recommended for inside use. The perforated pipe used for drainage has holes on 5 in. centers at 120 deg. spacing on the bottom of the pipe. Because of the type of pipe it can be installed in a wet trench which is an advantage in many instances.

More Industrial Wastes

The topic "Effects of Industrial Wastes" was introduced by **Richard Hazen,** Consulting Engineer of the firm of Malcolm Pirnie, Engineers, New York. Mr. Hazen pointed out that while the purpose of ultimate industrial waste treatment and sewage treatment may be the same, namely, to prevent excessive pollution of receiving waters, the factors to be considered in the treatment in arriving at the proper solution are usually quite different.

Frequently industrial wastes are a nuisance to the sewage plant operator. In some cases, certainly, industrial wastes are considered helpful; as for example, an industrial iron waste in one city actually assists in the coagulation and sedimentation of the sludge, but frequently acidity associated with iron waste causes more harm than benefits derived from the iron.

The operators usually prefer to divert industrial waste at the source and keep it out of the sewage, but this procedure is not always economical or practical, and it is often less expensive and better to dispose of industrial wastes along with domestic sewage rather than by separate plants, particu-

R. F. Rocheleau, Engr.
and
R. A. Eckloff, Prin. Engr.
New Hampshire Water
Pollution Commission
Concord, N. H.

Walter H. Sanderson
and
Thomas R. Komline
of
Komline-Sanderson Corp.
Ridgewood, N. J.

"Chan" Samson, Supt.
Sewage Works
Town of Tonawanda, N. Y.
and
"Dave" Squier
Darling Valve Co.
Rochester, N. Y.

"Bill" Stewart
W. H. Stewart Co.
Syracuse, N. Y.
and
"Jimmy" Angell
"Water & Sewage Works"
New York

"Fred" J. Biele
Consulting Engr.
Huntington, L. I.
and
Geo. W. Mowbry
Supt. Sewage Works
Port Chester, N. Y.

Chas. A. Niles Dike Sanitation Suffolk County Riverhead, L. I.

Chas. M. Gard Sanitary Engr. U. S. War Dept. Baldwin, N. Y.

"Shorty" Germond Distr. Mgr. Wallace & Tiernan New York

H. Vance Crawford Mgr., W. & S. Sales Genl. Electric Co. Schenectady, N. Y.

C. Geo. Andersen Sanitary Engr. Rockville Center, N. Y.

larly where the industrial waste volume is relatively small.

Mr. Hazen briefly classified industrial wastes under the headings excessive volume, excessive solids (organic or inorganic), and toxic. Excessive volume may result from batch operation; excessive solids may include such widely divergent materials as milk curds, tomato skins, metal filings, grit, and grease. Toxic chemicals may include not only such specific poisons as cyanide and arsenic, etc., but also excessive acidity or alkalinity that prevents proper biological treatment. Mr. Hazen cited a number of instances with which he was personally familiar in the matter of treating industrial wastes. These included removal of grease by evacuator, removal of a chrome blading waste to a septic tank to prevent its adverse effect on sewage plant operation, the effects of photographic wastes on chlorine residuals, waste from air station maintenance shops, and a coal storage area on a small water supply drainage station.

Mr. Hazen also stated that plans for sewage treatment works at Waterbury and Naugatuck made provisions for exclusion of industrial wastes from brass works in order that sludge digestion would not be adversely affected. Mr. Hazen then opened the meeting to discussion from various members of the audience. A number spoke, including Uhl T. Mann, Supt. of the Sewage Treatment Works at Syracuse, N. Y., and John W. Johnson, Supt., Sewage Treatment, Buffalo, N. Y.

Preparation and Presentation Of Technical Papers

In introducing the luncheon speaker of the second day's luncheon, **John W. Johnson**, Program Chairman, N.Y.S.S.W.A., predicted that although the program called for the topic, "Technical Papers, Their Preparation and Presentation," the audience should be prepared for a liberal dose of "Here and There with Doc Symons." True to the chairman's prediction, the paper turned out to be "The Audience Talks Back," one of **George E. (Doc) Symons'** after-dinner talks, in which the suggestions for the writing of technical papers and for their presentation at technical meetings were liberally interspersed with anecdotes and stories of actual happenings in the life of an editor and after-dinner speaker.

Operators' Salaries

The New England Sewage Works Association has a committee on operators' salaries which prepared its final report last September. This report was summarized and presented for discussion at the meeting in Albany by **Thomas R. Camp,** chairman of the committee and partner in Camp, Dresser & McKee, Consulting Engineers, Boston.

The committee report contains considerations of advisable legislation to promote the status of sewage treatment plant operators, including in particular licensing of operators and tenure of office. In the matter of classification and certification, this report follows the suggestion of the special committee of the Federation of Sewage Works Assns., which made its final report in the January 1946 Journal on "Qualifications of Sewage Treatment Plant Operators" and includes the division of Class A, Class B, and Class C plants.

The New England report points out that the field of opportunity for sewage treatment plant operators is relatively nil, and promotions are limited in individual communities. The New England Sewage Works Assn. Committee believes that in order to attract competent men to the field and to keep them it is essential that opportunities for promotion and advancement should not be restricted. Therefore, the committee believes that when an operator in one community reaches the limit of advancement that is desirable for both the community and the operator, that he have the opportunity to advance to a larger responsibility in a larger community. The committee therefore recommends that standards of qualifications and operators' salaries be made uniform as far as practicable so as to facilitate the promotion of an operator from a smaller to a larger community.

The report which Mr. Camp presented also contains a basic salary scale for sewage works operators and recommends that the New England Sewage Works Assn. support a movement for certification and licensing of sewage treatment operators throughout New England, preferably throughout the United States, substantially in accord with the recommendations of the Federation's Committee on Qualifications for Sewage Treatment Plant Operators. The committee further recommended that the proposed state certifying agencies should also act in an advisory capacity or otherwise towards the establishment of minimum salary scales for certified operators.

The report received a lively discussion from the audience with practically 100 per cent approval of the ideas and recommendations stated. A. F. Dappert, Secretary of the N.Y.S.S.W.A., proposed that a standing committee be set up in the New York Association to study operators' salaries in that state.

Pennsylvania Issues More Notices to Industry

The State Sanitary Water Board of Pennsylvania has recently issued notices requiring preparation of plans for treatment of industrial wastes for 21 additional industries. This brings the total number of industrial plants which have been required to prepare plans for waste treatment to abate pollution to a total of 471 since Pennsylvania's "Clean Streams" program was inaugurated. Already many of the plans from previous notices to other companies have been approved and in a number of cases treatment plants have been installed. A number of collieries in the anthracite coal regions have installed types of silt diversion systems, some building reclamation plants and silt ponds.

In addition to these 21 industries, 6 additional municipalities have received orders requiring the preparation of plans, thus bringing to a total of 547 municipalities and 471 industrial establishments which have received orders for preparation of plans.

GRAPHIC HEAT LOSS COMPUTATION FOR SLUDGE DIGESTERS

By JOHN G. MONTGOMERY
Civil and Sanitary Engineer
WASHINGTON, D. C.

THE problem of providing heat for sludge digestion tanks is largely one of original design at the time the engineer designs the complete treatment and disposal system. It sometimes becomes necessary, however, to install a heating system at existing plants, when the importance and need of such a heating system has been indicated by the operation troubles due to inefficient sludge digestion. The operating engineer will have available a "backlog" of operating records which will indicate the need of a heating system.

The technical solution of sludge digestion tank heating problems involves fundamental technic used in general heat transmission problems. Problems of heat transmission have terms such as "transfer," "transmission," "conductance," "radiation," "convection," and "conduction." In addition to the above factors or terms, there are a number of so-called co-efficients to be used for different component parts of the structure.

The designing engineer treats each heating application as an individual problem, involving a consideration of all heat losses through the structure, fresh sludge quantities and proper type of heat exchange equipment. When broken down into its component parts, the solution of such a problem becomes quite simple.

A series of graphic charts have been prepared by the writer and are presented herewith. The component parts of the structure have been broken down into one foot wall height for the entire perimeter of the structure or tank. Other component parts are the floating roof, the floor and the gas dome.

Diagram No. 1 indicates the Btu. required per hour to compensate or balance the heat losses transmitted through a circumambient inside wall area one foot in height, for two types of construction concrete, and concrete—2 inch air space—and 8 inches brick on outside. One set of curves is for walls exposed and one set of curves is for walls unexposed.

Diagram No. 2 indicates the required Btu. per hour to balance the heat losses transmitted through the roof and floor of the digester.

In both diagrams the abscissa is the tank diameter in feet and the ordinate is the heat loss in Btu.

Editor's Note: In June, 1943, there appeared in this magazine a veritable treatise by Norman C. Wittwer, Consulting Sanitary Engineer of Trenton, N. J., on the subject "Sewage Sludge Digestion Tank Heating." This basic reference article was reprinted on page R-215 of the June, 1945, Reference and Data Number of *Water Works and Sewerage*. Mr. Wittwer presented methods for the calculation of heat losses from sludge digesters and the heat input required to maintain digesters at prescribed temperatures, but the methods involved detailed calculation in each instance.

Recently *Water & Sewage Works* received two articles, each by an independent author, dealing with short cuts for using Mr. Wittwer's methods for calculating sludge digester heat losses. Believing both of these articles to be of interest, the two are presented herewith. The first by Mr. Montgomery utilizes a series of graphs and the second, by Mr. Candee, makes use of a table. Both articles are applicable to certain specific designs, but appear broad enough to be generally applicable in sewage works design.

How to Use the Charts

Heat loss computations illustrating the use of the charts to determine the Btu. losses from a digester are made in the following manner. Assume a tank of these dimensions:

Diameter ..... 60 ft.
Roof area .....2,800 sq. ft.
Inside circumference ..... 189 ft.
Bottom area (saucer and sump) .....3,640 sq. ft.

(A) *Construction of Wall* — Exposed above ground.
9 ft. high.
9 inches concrete plus 2 inches air space plus 8 inches brick.

(B) *Construction of Wall*—Unexposed below ground.
(First Section.)
2.5 ft. high.
9 inches concrete plus 2 inches air space plus 8 inches brick.
(Second Section)
8.5 ft. high.
9 inches concrete only.

To Determine Btu. Required

Floating roof and concrete floor. Enter diagram No. 2 at 60 ft. diameter to point of intersection with curve plotted for combined Btu. losses for floating roof and the floor of the structure. Read 210,000 + Btu.

Exposed wall (A). Enter diagram No. 1 at 60 ft. diameter to point of intersection with curve plotted for 9 inches concrete—2 inches air space and 8 inches brick. Read 5,325 Btu. losses from 1 foot height for the circumference of the tank wall. Multiply 5,325 by the total height of wall section (9 ft.) 5,325x9 = 47,925 Btu.

Unexposed digester wall (B). Enter diagram No. 1 at 60 ft. diameter to point of intersection with curve plotted for 9 inches concrete wall—2 inches air space and an 8 inch brick wall. Read 2,500 Btu. losses from 1 foot height for the circumference of the tank wall. Multiply 2,500 Btu. by the total height of the wall section (2½ ft.) 2,500x2.5 = 6,250 Btu.

Section B_2 Unexposed. Enter diagram No. 1 at 60 ft. diameter to point of intersection with curve plotted for 9 inch concrete wall only. Read 3,300 Btu. losses from 1 foot tank wall circumference. Multiply 3,300 Btu. by the total height of the wall section (8½ ft.) 3,300x8.5 = 28,050 Btu.

Total Btu. losses from walls.

	Btu.
Section A	47,925
Section B_1	6,250
Section B_2	28,050
Total	81,225

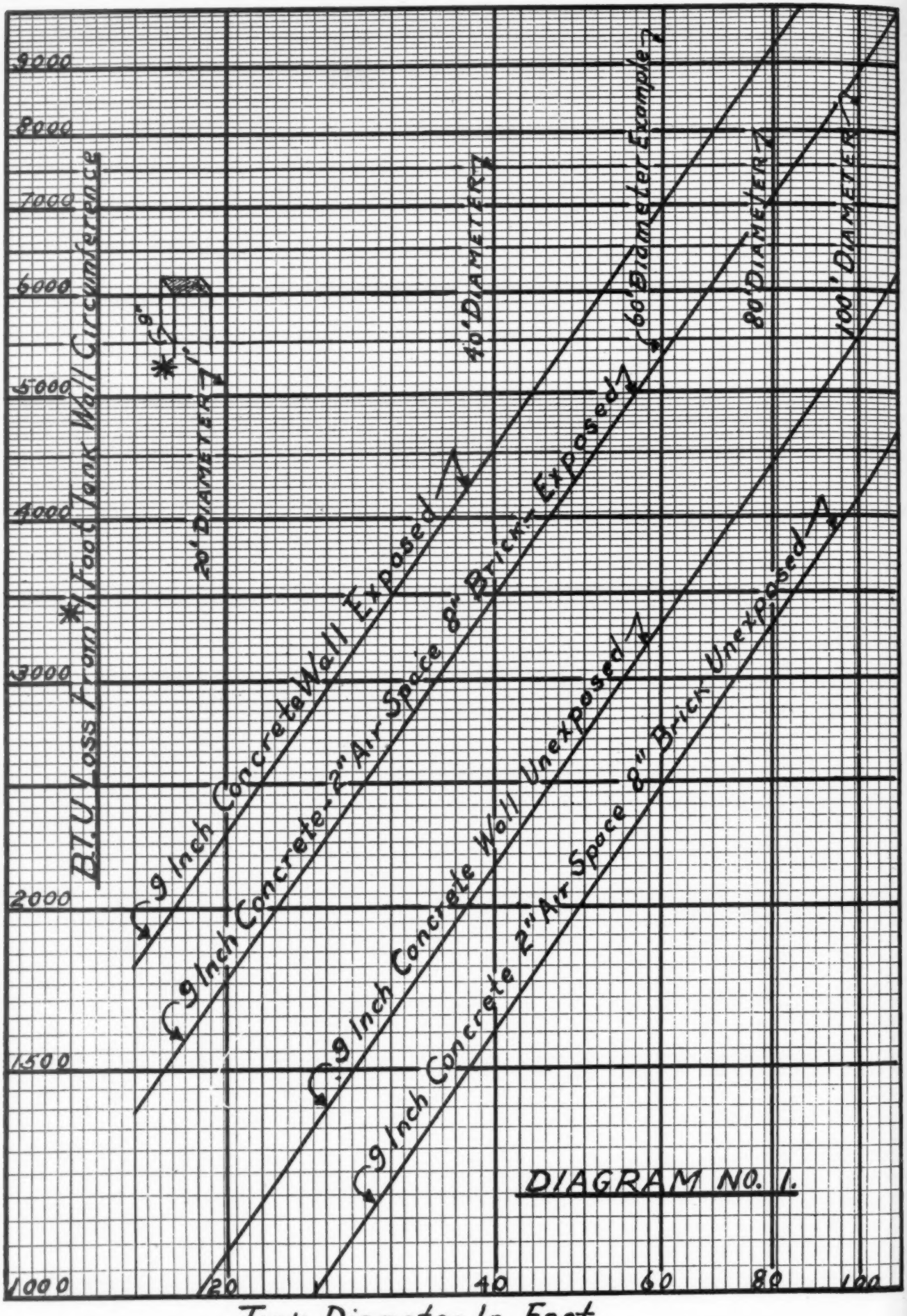
Total Btu. losses from wall sections, floating roof and concrete floor.

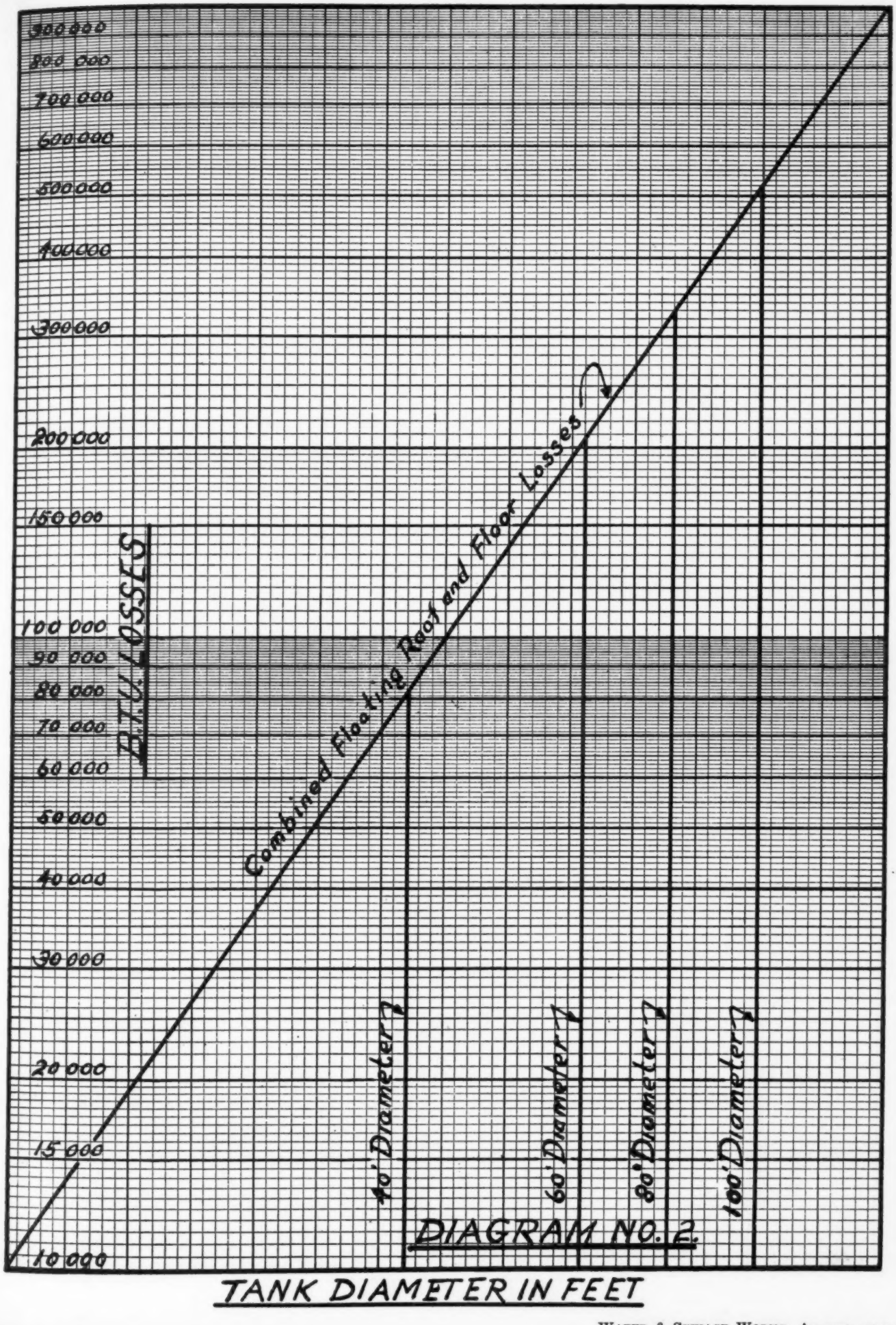
	Btu.
From wall	81,225
From roof and floor	210,000
Total	291,225

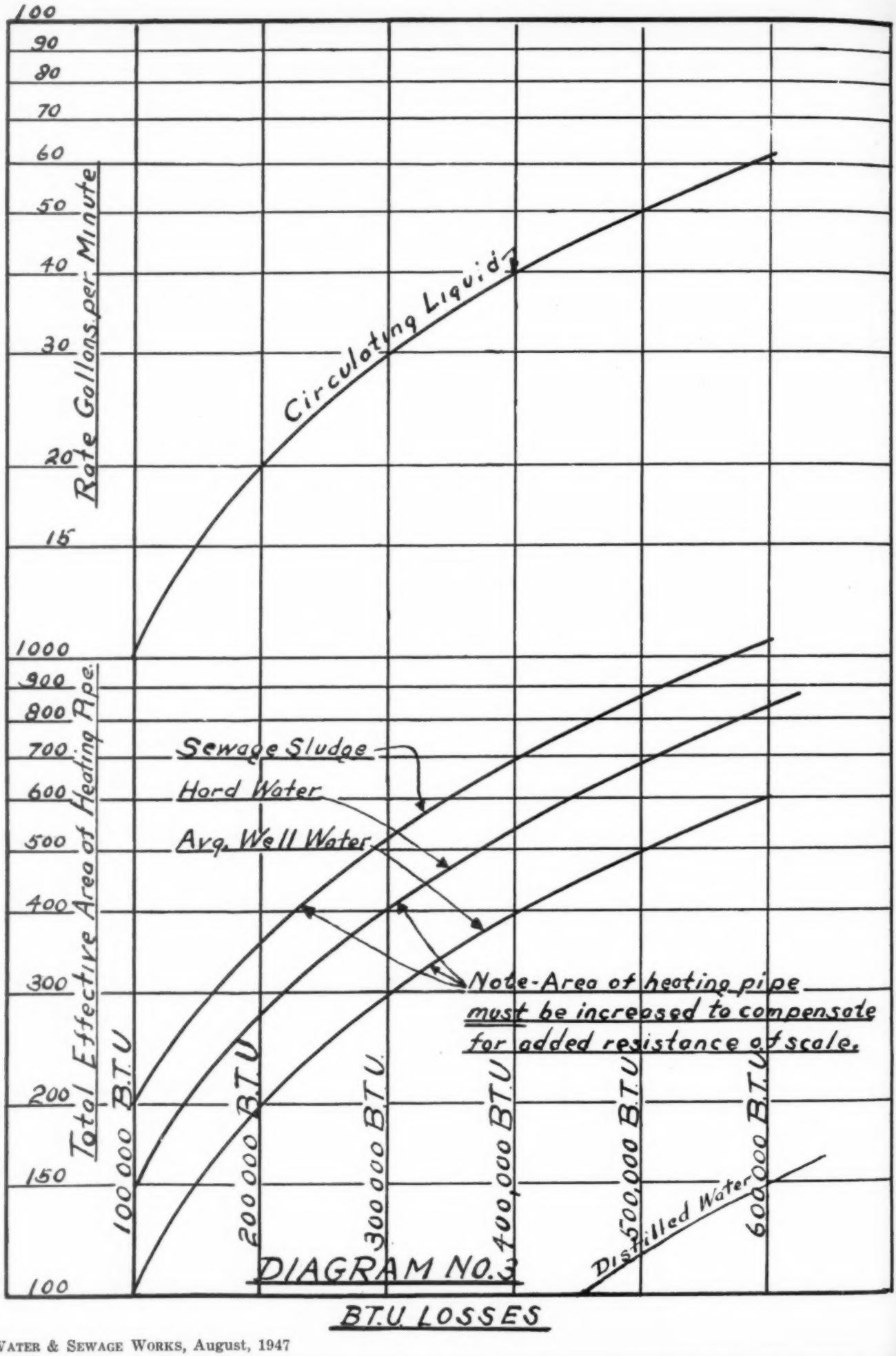
Heat required for fresh sludge addition.

Assume fresh sludge addition at 1 pound per day for each cubic foot of tank capacity.

60 ft. diameter of sludge digester.
Height to overflow 20 feet.
Cubic feet capacity = (Roof area × 20 ft.) 2,800 × 20 = 56,000 cubic feet.


B.T.U. Loss From Roof & Tank Wall Circumference
9000
8000
7000
6000
5000
4000
3000
2000
1500
1000
20' Diameter
40' Diameter
60' Diameter Example
80' Diameter
100' Diameter
9 Inch Concrete Wall Exposed
9 Inch Concrete-2" Air Space-8" Brick-Exposed
9 Inch Concrete Wall Unexposed
9 Inch Concrete 2" Air Space 8" Brick-Unexposed
DIAGRAM NO. 1.
20
40
60
80
100
Tank Diameter In Feet.


900 000
800 000
700 000
600 000
500 000
400 000
300 000
200 000
150 000
100 000
90 000
80 000
70 000
60 000
50 000
40 000
30 000
20 000
15 000
10 000
B.T.U. LOSSES
Combined Floating Roof and Floor Losses
40' Diameter
60' Diameter
80' Diameter
100' Diameter
DIAGRAM NO. 2.
TANK DIAMETER IN FEET


100
90
80
70
60
50
40
30
20
15
Rate Gallons per Minute
Circulating Liquid
1000
900
800
700
600
500
400
300
200
150
100
Total Effective Area of Heating Pipe
Sewage Sludge
Hard Water
Avg. Well Water
Note-Area of heating pipe must be increased to compensate for added resistance of scale.
100 000 B.T.U
200 000 B.T.U
300 000 B.T.U
400,000 B.T.U
500,000 B.T.U
600 000 B.T.U
Distilled Water
DIAGRAM NO. 3
B.T.U LOSSES

Heat required Btu. per hour.

$$\frac{56{,}000 \times 85° - 45°F}{24} = 93{,}333 \text{ Btu.}$$

The 93,333 Btu. required for fresh sludge addition is the gross Btu. required with 100 per cent liquid capacity of the digester. However, with only 66 per cent of the liquid capacity of tank being used, the net Btu. required for fresh sludge addition will approximate 6,100 Btu.

Recapitulation

A recapitulation of the Btu. losses follows, for a digester having a diameter of 60 feet. Outside temperature 0° F. Earth temperature 45° F. Temperature of liquid entering tank from heat exchanger 86° F. Temperature of liquid leaving tank 85° F.

	Btu./hr.
Walls	81,425
Roof and floor	210,000
Sludge (addition)	61,000
Total	352,425

The computations at this stage have indicated a loss of 352,425 Btu./hr.

The 352,425 Btu. per hour represents the "output" from the heat exchanger. The "input" to the heat exchanger at 85° efficiency will be 371,080 Btu. per hour.

The sludge gas has a heat value of 570 Btu. per cubic foot—and the gas consumption will be 651 cu. ft. per hr.

Heat Exchanger

To help in the selection of the proper heat exchanger, several types of heat exchangers and their characteristics are presented as follows:

250 × 1000 = rating of exchanger
Pump capacity = 150 gals. per min.
Temperature rise = 1° F
Gas consumption = 500 cu.ft. per hr.
Cubic feet gas per minute = 8.3

370 × 1000 = rating of exchanger
Pump capacity = 150 gals. per min.
Temperature rise = 1° F
Gas consumption = 750 cu.ft. per hr.
Cubic feet gas per minute = 12.5

It has been computed the gas consumption in cubic feet per hour will approximate 650. The 370x1000 exchanger has a gas consumption of 750 cu. ft. per hour, and a heat exchanger of this type will be suitable to furnish and transmit all the heat required to compensate the Btu. losses from the structure.

The type of sludge heating system using the heat exchanger, described above, are designed to handle the tank liquid without employing vertical banks of pipes within the digester.

Other Systems

In the design of sludge tank heating systems, it should be remembered there are several schemes used in the generation and distribution of heat to the liquids in sludge digester.

One type will be included with this article where the liquid will be heated outside of vertical banks of piping with free convection (without mechanical means of producing mobility of the tank liquid).

To assist in the design of systems where the liquid is to be heated outside of vertical banks of piping, a series of curves have been compiled and plotted on Diagram No. 3. This diagram indicates the rate of hot water circulation in gallons per minute required to replace the heat lost through the structure and the added sludge. The total effective area of the heating pipe surface area required to transmit the heat generated by heat generator (boiler) or exchanger can be determined from the set of curves labeled—"sewage sludge," "hard water," "average well water," and "distilled water." It will be noted the values for effective area increases from distilled water to sewage sludge, this increase is due to an allowance being made to compensate for the extra heat units needed to heat the liquids; this difference is absorbed in an increase in effective pipe area.

Example—Piping & Circulating water. The total Btu. losses through the 60 ft. diameter digester are known to be 352,425 Btu. per hour. How many feet of 2½ inch W. I. pipe will be required to heat the sludge in the digester.

Enter diagram at a Btu. loss of 360,000 Btu. to the point of intersection with average well water curve and read 350 sq. ft. as the effective area of the heating pipe.

The external area of 2½ in. wrought iron pipe is .753 sq. ft. per foot of length. The minimum length of heating pipe required will be 350 ÷ .753 = 464 lineal feet.

One spiral pipe coil of 59 ft. (1 foot less than the diameter) has a length of 175 ft. Thus the minimum number of coils required is 350 ÷ 175 = 2.

Circulating water. Enter diagram at a Btu. loss of 360,000 Btu. (on upper curve) to the point of intersection with curve labeled "circulating liquid" and find 36 gal. per min.

Purdue's Third Industrial Waste Conference

The Third Industrial Waste Conference of Purdue University was successfully held on May 21 and 22. Sponsored by the School of Civil Engineering, Dept. of Sanitary Engineering, and the Technical Extension Div., in cooperation with the Indiana State Boards of Health and Conservation and several manufacturers' associations. This conference drew 260 registrants from 18 different states. Representatives from industry made up the largest percentage of the registrants.

Don E. Bloodgood, Gen. Chairman

Under the general chairmanship of Prof. **Don E. Bloodgood,** Assoc. Prof. of Sanitary Engineering, 59 persons appeared on the technical program. In addition to two general sessions held on the first day there were six symposia held on the second day. These symposia were devoted to wastes from paper manufacturing, fermentation process, metal plating, food processing, dairy and miscellaneous industries.

Keynoting the general session, **E. C. Lathrop** of the Northern Regional Research Laboratory gave a talk on "Increasing the Value of Waste Products." He condemned the wastefulness of America with its resources.

This paper was followed by a discussion on how to determine when a stream is polluted by **R. B. Wiley** and **W. E. Howland** of the Purdue School of Civil Engineering.

At the banquet, **Kenneth A. Reid** of the Izaak Walton League of America told "What the Izaak Walton League Is Trying to Do."

The luncheon on the second day was addressed by **Peter DePaolo,** winner of the 1925 Indianapolis Motor Speed Race.

W. H. Wisely, Exec. Secy. of the Federation of Sewage Works Assns., talked on industrial wastes activity in the Federation.

The complete success of the Third Industrial Waste Conference of Purdue University has indicated that this annual meeting has taken its place as one of the outstanding conventions of the year, as it is the only regular meeting devoted strictly to industrial waste problems.

TABLES FOR COMPUTING HEAT LOSSES FROM DIGESTERS

By HENRY B. CANDEE*
Sanitary Engineer
WASHINGTON, D. C.

VARIOUS methods for estimating heat losses through digester walls, floors, and covers have been used with varying degrees of accuracy. Those methods which give any real consideration to varying conditions such as materials of construction, wall thicknesses, film coefficients, thermal conductivity, or special ground conditions are usually cumbersome to use and because of their very nature are subject to errors through inadvertent omissions.

Based upon the design methods presented by Norman C. Wittwer in his article "Sewage Sludge Digestion Tank Heating" which appeared in *Water & Sewage Works* Reference and Data number, p. R-215, June,1945, the following tables have been prepared for use in determining heat losses through digester walls, covers, etc. These tables are by no means complete for every case which may arise, but it is believed that they are broad enough to be successfully used for the majority of smaller tanks with an extremely low percentage of error.

Although it would appear that the tables are self-explanatory, it has been deemed advisable to include a typical example to illustrate their use.

Problem

What are the heat losses for the digester shown in the accompanying figure, including 100 cu. ft. of fresh sludge added per day? Outside minimum temperature 10° F. above zero, ground temperature at 45° F. below the frost line and 30° F. above the frost line, and temperature of digester contents maintained at 85° F.

Solution

Tank diameter is 25 feet.
Horizontal area of tank (cover) is 491 sq. ft.
Total inside circumference of tank is 78.5 ft.
Portion of circumference protected by-valve house is 10.5 ft.
Portion of circumference not protected by valve house is 68 ft.
Floor area is 497 ft.

Calculations

I—Portion in wet earth (Floor and bottom one foot of wall)—(Ground temp. 45° F.)
Area of bottom 1 ft. of wall is $68 \times 1 = 68$ sq. ft.
Area of floor = 497 sq. ft.
Then $t_i - t_o = 85 - 45 = 40°$ F from table, C = 40 for floor and C = 26.67 for wall, so: $H_1 = 497 \times 40 + 68 \times 26.67 =$ .....21,690 Btu/hr.

II—Portion in dry earth below frost line—(Ground temp. 45° F.)
Area of wall is $68 \times 5 = 340$ sq. ft.
Then $t_i - t_o = 85 - 45 = 40°$ F from table, C = 20,
so: $H_2 = 340 \times 20 =$ ..... 6,800 Btu./hr.

III—Portion in dry earth above frost line—(Ground temp. 30° F.)
Area of wall is $68 \times 4 = 272$ sq. ft.
Then $t_i - t_o = 85 - 30 = 55°$ F from table, C = 27.5 (disregard rests for brick wall and cover), so:
$H_3 = 272 \times 27.5 =$ ..... 7,480 Btu./hr.

IV—Portion above ground—(Outside air temp. 10° F.)
Area of wall is $68 \times 10 = 680$ sq. ft.
Then $t_i - t_o = 85 - 10 = 75°$ F from table, C = 30,
so: $H_4 = 680 \times 30$ .....20,400 Btu/hr.

V—Lower portion of wall protected by building—(Building temp. 60° F.)
Area of wall is $10.5 \times 10 = 105$ sq. ft.
Then $t_i - t_o = 85 - 60 = 25°$ F from table, C = 15.65,
so: $H_5 = 105 \times 15.65 =$ ..... 1,640 Btu/hr.

VI—Upper portion of wall protected by building—(Building temp. 60° F.)
Area of wall is $10.5 \times 10 = 105$ sq. ft.
Consider building temperature to be 60° F
Then $t_i - t_o = 85 - 60 = 25°$ F from table, C = 19.65,
so: $H_6 = 19.65 \times 105 =$ ..... 2,060 Btu./hr.

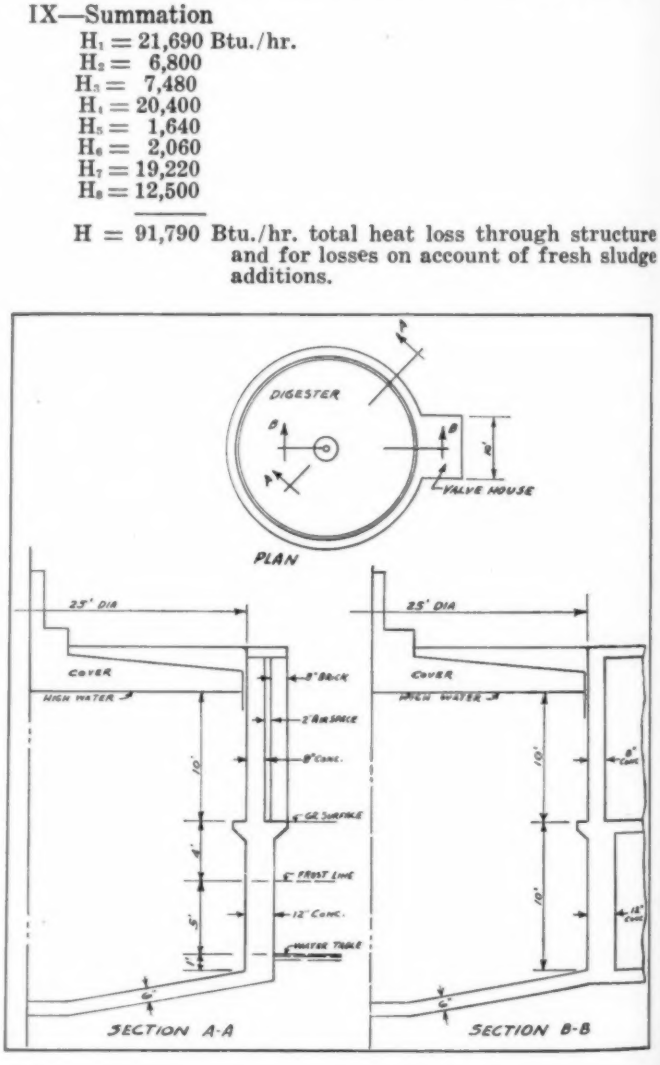
VII—Cover—(Outside air temp. 10° F.)
Area is 491 sq. ft.
Then $t_i - t_o = 85 - 10 = 75°$ F from table, C = 39.15,
so: $H_7 = 491 \times 39.15 =$ .....19,220 Btu./hr.

VIII—Sludge—(Temp. 45° F.)
Total volume per day is 100 cu. ft.
Then $t_i - t_o = 85 - 45 = 40°$ F from table, C = 125,
so: $H_8 = 100 \times 125 =$ .....12,500 Btu./hr.

IX—Summation

$H_1 = 21,690$ Btu./hr.
$H_2 = 6,800$
$H_3 = 7,480$
$H_4 = 20,400$
$H_5 = 1,640$
$H_6 = 2,060$
$H_7 = 19,220$
$H_8 = 12,500$

$H = 91,790$ Btu./hr. total heat loss through structure and for losses on account of fresh sludge additions.



*The Veterans' Administration.

HEAT LOSS COEFFICIENTS
For Various Temperature Differences
Various Thicknesses of Concrete Digester Walls, and Various Locations of Exposed Surface.

C = HEAT LOSS COEFFICIENT IN B.T.U./HR./SQ.FT. SURFACE

TEMP DIF. °F ($T_i - T_o$) *	SIDE OR BOTTOM BELOW GROUND				SIDE ABOVE GROUND				SIDE PROTECTED BY BUILDING				COVER (P.F.T OR EQUAL)	CONCRETE SIDE OR BOTTOM IN WET EARTH				8" BRICK, 2" AIR SPACE & CONCRETE ABOVE GROUND				C-COEF. IN B.T.U. PER HR. PER CU. FT WET SLUDGE ADDED PER DAY
														THICKNESS OF CONCRETE				THICKNESS OF CONCRETE				
	6"	8"	10"	12"	6"	8"	10"	12"	6"	8"	10"	12"		6"	8"	10"	12"	6"	8"	10"	12"	
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	3.33	3.0	2.75	2.5	7.50	6.0	5.0	4.29	4.52	3.93	3.48	3.13	2.61	5.0	4.29	3.76	3.33	2.14	2.0	1.88	1.76	15.63
10	6.67	6.0	5.50	5.0	15.00	12.0	10.0	8.57	9.04	7.86	6.96	6.26	5.22	10.0	8.57	7.52	6.67	4.28	4.0	3.75	3.52	31.25
15	10.00	9.0	8.25	7.5	22.49	18.0	15.0	12.86	13.56	11.79	10.44	9.39	7.83	15.0	12.86	11.28	10.00	6.42	6.0	5.63	5.28	46.88
20	13.33	12.0	11.00	10.0	29.98	24.0	20.0	17.15	18.08	15.72	13.92	12.52	10.44	20.0	17.15	15.04	13.33	8.56	8.0	7.50	7.04	62.50
25	16.67	15.0	13.75	12.5	37.48	30.0	25.0	21.44	22.60	19.65	17.40	15.65	13.05	25.0	21.44	18.80	16.67	10.70	10.0	9.38	8.80	78.13
30	20.00	18.0	16.50	15.0	44.98	36.0	30.0	25.72	27.12	23.58	20.88	18.78	15.66	30.0	25.72	22.56	20.00	12.84	12.0	11.26	10.56	93.75
35	23.33	21.0	19.25	17.5	52.47	42.0	35.0	30.01	31.64	27.51	24.36	21.91	18.27	35.0	30.01	26.32	23.33	14.98	14.0	13.13	12.32	109.38
40	26.67	24.0	22.00	20.0	59.97	48.0	40.0	34.30	36.16	31.44	27.84	25.04	20.88	40.0	34.30	30.08	26.67	17.12	16.0	15.01	14.08	125.00
45	30.00	27.0	24.75	22.5	67.46	54.0	45.0	38.58	40.68	35.37	31.32	28.17	23.49	45.0	38.58	33.84	30.00	19.26	18.0	16.88	15.84	140.63
50	33.33	30.0	27.50	25.0	74.96	60.0	50.0	42.87	45.20	39.30	34.80	31.30	26.10	50.0	42.87	37.60	33.33	21.40	20.0	18.76	17.60	156.25
55	36.67	33.0	30.25	27.5	82.46	66.0	55.0	47.16	49.72	43.23	38.28	34.43	28.71	55.0	47.16	41.36	36.67	23.54	22.0	20.64	19.36	171.88
60	40.00	36.0	33.00	30.0	89.95	72.0	60.0	51.44	54.24	47.16	41.76	37.56	31.32	60.0	51.44	45.12	40.00	25.68	24.0	22.51	21.12	187.50
65	43.33	39.0	35.75	32.5	97.45	78.0	65.0	55.73	58.76	51.09	45.24	40.69	33.93	65.0	55.73	48.88	43.33	27.82	26.0	24.39	22.88	203.13
70	46.67	42.0	38.50	35.0	104.94	84.0	70.0	60.02	63.28	55.02	48.72	43.82	36.54	70.0	60.02	52.64	46.67	29.96	28.0	26.26	24.64	218.75
75	50.00	45.0	41.25	37.5	112.44	90.0	75.0	64.31	67.80	58.95	52.20	46.95	39.15	75.0	64.31	56.40	50.00	32.10	30.0	28.14	26.40	234.38
80	53.33	48.0	44.00	40.0	119.94	96.0	80.0	68.59	72.32	62.88	55.68	50.08	41.76	80.0	68.59	60.16	53.33	34.24	32.0	30.02	28.16	250.00
85	56.67	51.0	46.75	42.5	127.43	102.0	85.0	72.88	76.84	66.81	59.16	53.21	44.37	85.0	72.88	63.92	56.67	36.38	34.0	31.89	29.92	265.63
90	60.00	54.0	49.50	45.0	134.93	108.0	90.0	77.17	81.36	70.74	62.64	56.34	46.98	90.0	77.17	67.68	60.00	38.52	36.0	33.77	31.68	281.25

*T_i = Maintained temperature inside digester.
T_o = Outside temperature.
Note: Coefficients for portions below ground based on dry earth.
Example—Given: Digester to be kept at 85°F; outside ground temperature = 45°F (portion of tank below frost line is, say 10 feet); wall to be 10 in. conc.; tank is 20 feet dia. inside; exposed surface = 20 x 3.14 x 10 = 623 sq. ft.; $T_i - T_o = 85° - 45° = 40°F$.
From table: For 40°F and 10 in. wall below ground, C = 22.0
Heat loss through this portion of wall = 623 x 22 = 13,816 B.t.u. per hour.

WATER AND SEWAGE WORKS NEEDS OF THE UNITED STATES

U.S.P.H.S. Completes Survey Revealing Nation's Need of More than $2,000,000,000 of Water Supply Facilities and Almost $4,000,000,000 of Sewage Works Facilities.

THE cost of needed water supply and waste disposal facilities for the United States is estimated at $7,834,581,000 according to a nationwide inventory of sanitation needs recently completed by the Sanitary Engineering Division of the U. S. Public Health Service.

State Health Departments of all States, as well as hundreds of city and county health departments, cooperated with the Public Health Service in obtaining this tally of the cost of furnishing good water and sanitary waste disposal to the entire nation.

To obtain exact data on varied types and sizes of communities, engineers of the National Public Health Service studied the sanitation facilities of 78 million persons in 5800 communities. Inspection of local plants, conferences with local officials, and laboratory findings of state and local health departments were used in carrying out the survey. Needs of unsurveyed communities were estimated on the basis of surveyed communities of similar size.

Commenting on the survey, Dr. Thomas Parran, Surgeon General, declared:

"A sanitary environment for everyone is a basic requirement of a national health program. By furnishing data on the volume of construction needs, the survey will guide future action aimed at providing nationwide protection against filth-borne diseases."

108,000,000 Americans Lack Adequate Water Supplies

Results indicate that more than 2 million persons, living in communities of over 200 population, have no community water supply system and 79 million have systems needing improvements. Less than 11 million live in communities for which no water supply improvements are scheduled. More than six million persons in towns and cities need new sewerage systems; over 79 million need improved systems; and only about 6½ million are served by adequate systems at present.

In rural areas, more than 27 million persons need new or improved water supplies and only 12 million have reasonably good water. More than 33 million rural people have unsatisfactory sewage disposal systems and only six million are reasonably well provided for in this respect.

To remedy this condition, the nation needs an additional $2,200,000,000 worth of water works; $3,700,000,000 of sewerage facilities; $166,000,000 of garbage facilities; and $1,600,000,000 of all types of sanitation facilities for rural homes. These estimates reflect average costs of June, 1946, when the *Engineering News Record* construction cost index stood at 348, this figure being based on 1913 costs as 100.

Construction Plans Underway

Almost 40 per cent of this needed construction is at least in the planning stage, according to the survey.

In connection with sewerage over 9 per cent of needed sewerage facilities, to cost approximately $360,509,000, is ready for construction now and an additional 24 per cent, to cost $908,048,000, is being definitely planned.

In connection with water supply almost 17 per cent of the needed water supply systems, to cost $381,829,000, is ready for construction now and plans are in progress for an additional 27 per cent, to cost $612,111,000.

Two-thirds of the work that is ready for construction and half of that in the planning stage are in cities of more than 100,000. These cities include about 41 per cent of the total population in all communities. On the other hand, in towns of less than 1,000 only about 10 per cent of the needs will be met by projects now ready for construction or in the planning stage.

"The long continued difficulty of obtaining materials, the high cost of construction, and the unwillingness of local and other governments to enter into competition for materials and labor needed for housing have made most communities continue to defer all work but that needed to meet emergency needs," the report states. It predicts, however, that a rate of expenditure exceeding any rate attained in the past 20 years will be reached when construction costs become more stable and labor and materials more readily available.

Costs High for Farms And Big Cities

Per capita costs of needs vary from about $23 in Rhode Island to $107 in New York and average about $60 for the nation as a whole. Costs tend to be high in the States with high per capita incomes. The high cost of needed work in some of the larger cities is reflected in some of the large State totals. Water and sewage works needs of New York City will require an expenditure of over $1,000,000,000; Philadelphia, about $450,000,000; Chicago, $220,000,000; Detroit, $150,000,000; St. Louis, $85,000,000; Pittsburgh and Allegheny County, $80,000,000; Denver, $70,000,000.

The per capita cost of needs is greatest in the smallest communities and in the largest. In towns of less than 1,000 population, needs exceed $100 per capita while in cities of over 100,000 population needs are somewhat more than $80 per capita. In the towns of intermediate size, the cost will be less than $50 per capita and in rural areas about $40 per capita.

Cost of Water Supplies

About one-third of the 2.2 billion dollar need for water works is for the development of water supply sources. This reflects the high cost of completing New York City's Delaware watershed supply; development of an upland supply to replace Philadelphia's present highly polluted supply sources; and additional developments to augment Denver's existing sources of supply. Approximately one-sixth of the water works needs is for treatment facilities and about

TABLE I

Estimated Cost of Needed Water Works, Sewage Works, Garbage and Refuse Disposal, and Rural Sanitation Facilities By States and Size of Community (Costs in Thousands of Dollars)

State	Population (1940)	Water Works	Sewage Works	Garbage and Refuse Disposal	Rural Sanitation	Total
Alabama	$ 2,833	$ 16,482	$ 31,171	$ 1,171	$ 81,492	$ 130,316
Arizona	499	7,675	10,839	564	27,325	46,403
Arkansas	1,949	21,696	26,156	1,866	68,664	118,382
California	6,907	120,963	132,762	3,626	26,308	283,659
Colorado	1,123	85,179	10,447	703	10,535	106,864
Connecticut	1,709	20,120	39,194	3,797	7,644	70,755
Delaware	267	2,061	8,027	338	2,218	12,644
District of Columbia	663	41,427	11,228	2,372	.....	55,027
Florida	1,897	38,004	73,388	3,319	30,623	145,334
Georgia	3,124	22,071	48,050	2,682	104,200	177,003
Idaho	525	8,993	11,928	442	5,879	27,242
Illinois	7,897	138,259	236,536	7,842	106,320	488,957
Indiana	3,428	43 458	91,309	3,838	33,129	171,734
Iowa	2,538	32,688	66,242	1,864	59,420	160,214
Kansas	1,801	21,221	49,981	2,273	22,429	95,904
Kentucky	2,846	22,051	40,410	1,965	42,933	107,359
Louisiana	2,364	32,712	37,656	2,866	54,283	127,517
Maine	847	6,313	19.988	415	19,598	46,314
Maryland	1,821	45,485	43,606	2,575	10,458	102,124
Massachusetts	4,317	54,089	70,258	5,750	5,818	135,915
Michigan	5,256	134,842	153,096	4,771	30,940	323,649
Minnesota	2,792	45,805	56,252	4,214	32,264	138,535
Mississippi	2,184	11.366	20,892	1,372	44,330	77,960
Missouri	3,785	52,132	120,132	4,885	43,183	220,332
Montana	559	8,596	8,765	323	8,807	26,491
Nebraska	1,316	19,252	29,011	1,830	22,896	72,989
Nevada	110	1,868	2,204	148	1,351	5.571
New Hampshire	492	6,344	10,165	120	5,948	22,577
New Jersey	4,160	33.084	149,396	8,208	22,347	213,035
New Mexico	532	5,490	11,147	416	8,429	25,482
New York	13,479	247,182	1,100,303	38,890	61,075	1,447,450
North Carolina	3,572	52,720	65,410	5,729	76,890	200.749
North Dakota	642	16,457	12,127	718	6,519	35,821
Ohio	6,908	118,264	137,006	10,876	30,461	296,607
Oklahoma	2,336	26,940	36,276	3,160	45,632	112,008
Oregon	1,090	18,067	29,950	699	10,560	59,276
Pennsylvania	9,900	427,983	340,949	9,394	121,931	900.257
Rhode Island	713	5,422	8,917	341	1,684	16,364
South Carolina	1,900	10.946	22,484	1,600	25,752	60,782
South Dakota	643	13,001	10,301	660	18,196	42,158
Tennessee	2,916	18,833	50,250	3,428	89,991	162,502
Texas	6,415	80,407	79,040	3,838	68,240	231,525
Utah	550	13,278	27,733	546	2,308	43,865
Vermont	359	2,023	4,297	250	4,550	11,120
Virginia	2,678	34,460	51,324	2,809	47,894	136,487
Washington	1,736	35,418	45,616	2,315	18,262	101,611
West Virginia	1,902	15,591	63,508	1,427	22,503	103.029
Wisconsin	3,138	25,942	38,325	2,988	54,731	121,986
Wyoming	251	6,322	4,801	303	3,270	14,696
	$131,669	$2,268,982	$3,748,853	$166,526	$1,650,220	$7,834,581
Size of Community						
200- 500	$ 4,109	$ 235,918	$ 263,972	$ 6,842	$	$ 506,732
500- 1,000	3,582	125,804	218,463	8,589	.....	352,856
1,000- 5,000	13,181	255,889	558,682	33,631	.....	848,202
5,000- 10,000	7,386	113,579	219.665	15,043	.....	348.287
10,000- 25,000	10,156	153,057	237,494	18,731	.....	409,282
25,000- 50,000	7.377	109,232	161,102	12,908	.....	283,242
50,000-100,000	7,551	100,896	177,226	9,327	.....	287,449
Over 100,000	38,145	1,174,607	1.912,249	61,455	.....	3,148,311

Populations obtained from 1940 Census, Community populations include both incorporated and unincorporated communities. Where more than one community was served by a single water or sewerage system they were considered as a single community.
Note: Returns for Georgia and Virginia being incomplete, totals estimated in order to obtain national totals.

one-half will be for distribution system improvements and extensions.

These water works needs include *5,700 complete water works systems,* most of them for towns of less than 1,000 population and improvements to the systems in 14,800 other communities. Some 3,200 new water treatment plants are needed as well as improvements or additions to 4,700 existing plants. More than 45,000 miles of water mains of various sizes are needed for the distribution systems.

Sewage Works and Garbage Disposal

The cost of sewage works needs is about 3.7 billion dollars of which about one-third is for treatment works and most of the remainder for collecting and intercepting sewers. This will provide more than 80,000 miles of sewers, more than 12,000 new sewage treatment plants and additions to some 1,000 existing plants. *Complete sewer systems are needed by 9,100 communities,* most of them small ones.

Some 12,000 trucks are needed for garbage and refuse collection services. These will cost almost 50 million dollars. About 70 million dollars is needed to build 1,090 incinerators and 25 million dollars is needed for equipment such as bulldozers and draglines to operate 5,500 sanitary land fills. Land and miscellaneous expenses will require an additional 20 million dollars. As in the case of water and sewage works, the more populous States and the largest cities have the greatest needs for garbage and refuse disposal facilities.

TABLE II

Water Works Needs

Estimated Cost of Various Elements and Status of Projects by States and Size of Community

State	Supply Source $1,000's	Treatment $1,000's	Distrib. System $1,000's	Miscellaneous $1,000's	Ready for Construction $1,000's	Ready for Construction Pct.	Planning in Progress $1,000's	Planning in Progress Pct.	Projects for Future $1,000's	Projects for Future Pct.	Total Costs $1,000's
Alabama	2,813	2,910	10,041	718	2,696	16.4	6,420	38.9	7,366	44.7	16,482
Arizona	575	150	1,923	5,027	596	7.7	1,050	13.7	6,029	78.6	7,675
Arkansas	2,523	3,340	15,766	67	736	3.4	2,269	10.5	18,691	86.1	21,696
California	4,180	11,728	101,583	3,472	9,752	8.1	60,040	49.6	51,171	42.3	120,963
Colorado	68,684	5,174	10,990	331	2,268	2.7	74,225	87.0	8,686	10.3	85,179
Connecticut	10,617	2,285	7,005	213	8,377	41.6	6,616	32.9	5,127	25.5	20,120
Delaware	40	462	1,547	12	378	18.4	1,511	73.3	172	8.3	2,061
District of Columbia	2,713	8,088	27,092	3,534	626	1.5	11,185	27.0	29,616	71.5	41,427
Florida	1,864	9,458	24,265	2,417	3,666	9.6	14,712	38.8	19,626	51.6	38,004
Georgia	2,914	4,075	14,122	960	3,209	14.5	8,534	38.6	10,328	46.9	22,071
Idaho	448	719	7,791	35	487	5.4	1,019	11.3	7,487	83.3	8,993
Illinois	3,091	75,748	57,574	1,846	9,234	6.7	75,251	54.5	53,774	38.8	138,259
Indiana	2,207	15,644	25,296	311	3,847	8.9	4,825	11.1	34,786	80.0	43,458
Iowa	3,395	10,709	18,268	316	4,162	12.7	4,931	15.1	23,595	72.2	32,688
Kansas	1,869	3,919	15,335	98	1,135	5.4	7,684	36.2	12,402	58.4	21,221
Kentucky	2,705	4,617	14,542	187	570	2.6	3,656	16.6	17,825	80.8	22,051
Louisiana	1,138	6,129	24,263	1,182	4,957	15.2	1,883	5.8	25,872	79.0	32,712
Maine	651	396	5,220	46	359	5.7	171	2.7	5,783	91.6	6,313
Maryland	26,317	4,863	14,149	156	1,373	3.0	35,830	78.8	8,282	18.2	45,485
Massachusetts	7,473	5,717	39,421	1,478	8,697	16.1	16,635	30.7	28,757	53.2	54,089
Michigan	2,752	11,272	119,130	1,688	32,762	24.3	43,114	31.9	58,966	43.8	134,842
Minnesota	4,174	5,194	36,360	77	3,209	7.0	6,838	14.9	35,758	78.1	45,805
Mississippi	621	1,286	8,702	757	1,137	10.0	4,507	39.6	5,722	50.4	11,366
Missouri	5,062	9,626	33,505	3,939	1,086	2.1	11,674	22.3	39,372	75.6	52,132
Montana	428	1,337	6,830	1	609	7.1	2,166	25.1	5,821	67.8	8,596
Nebraska	2,253	4,631	12,042	326	824	4.3	11,781	61.2	6,647	34.5	19,252
Nevada	210	61	1,590	7	292	15.6	192	10.3	1,384	74.1	1,868
New Hampshire	656	1,894	3,779	15	0	0	0	0	6,344	100.0	6,344
New Jersey	5,768	3,741	20,846	2,729	3,461	12.4	4,436	11.5	25,187	76.1	33,084
New Mexico	842	289	4,133	226	278	5.1	724	13.2	4,488	81.7	5,490
New York	163,203	18,235	64,922	822	162,813	65.8	17,435	7.1	66,934	27.1	247,182
North Carolina	10,273	11,417	30,499	531	5,493	10.5	15,085	28.6	32,142	60.9	52,720
North Dakota	1,467	2,613	12,353	24	1,209	7.3	4,157	25.4	11,091	67.3	16,457
Ohio	12,963	48,450	54,862	1,989	41,315	34.8	27,269	23.1	49,680	42.1	118,264
Oklahoma	3,709	4,730	18,202	299	3,223	12.0	7,956	29.5	15,761	58.5	26,940
Oregon	985	1,361	15,637	84	409	2.3	11,160	61.8	6,498	35.9	18,067
Pennsylvania	357,851	20,354	49,645	133	17,708	4.1	24,048	5.6	386,227	90.3	427,983
Rhode Island	6	2,842	1,541	1,033	1,879	34.7	0	0	3,543	65.3	5,422
South Carolina	1,293	2,786	6,579	288	2,746	25.1	3,229	29.5	4,971	45.4	10,946
South Dakota	1,405	4,692	6,893	11	402	3.1	1,723	13.2	10,876	83.7	13,001
Tennessee	1,232	2,254	13,968	1,379	1,483	7.9	6,837	36.2	10,513	55.9	18,833
Texas	18,109	11,651	47,451	3,196	17,998	22.4	22,970	28.6	39,439	49.0	80,407
Utah	741	1,474	10,972	91	4,320	32.5	3,190	24.0	5,768	43.5	13,278
Vermont	421	864	708	30	29	1.4	4	0.2	1,990	98.4	2,023
Virginia	12,276	5,332	16,380	472	2,336	6.8	17,235	50.0	14,889	43.2	34,460
Washington	3,922	1,987	28,208	1,301	2,539	7.2	13,990	39.5	18,889	53.3	35,418
West Virginia	1,601	2,531	10,441	1,018	1,059	6.8	2,731	17.4	11,801	75.8	15,591
Wisconsin	1,907	3,371	19,969	695	2,571	9.9	8,204	31.6	15,167	58.5	25,942
Wyoming	656	1,365	4,298	3	1,514	23.9	1,009	15.8	3,799	60.3	6,322
Total	763,003	363,771	1,096,638	45,570	381,829	16.8	612,111	27.0	1,275,042	56.2	2,268,982
Size of Community											
200- 500	31,477	14,616	183,923	5,902	7,685	3.3	13,680	5.8	214,553	90.9	235,918
500- 1,000	13,177	16,959	92,887	2,781	10,227	8.1	18,362	14.6	97,215	77.3	125,804
1,000- 5,000	19,317	52,216	180,513	3,843	21,811	8.5	57,504	22.5	176,574	69.0	255,889
5,000- 10,000	10,145	32,812	68,985	1,637	15,225	13.4	38,076	33.5	60,278	53.1	113,579
10,000- 25,000	14,563	36,722	99,766	2,006	25,892	16.9	52,122	34.1	75,043	49.0	153,057
25,000- 50,000	13,286	26,021	66,767	3,158	12,917	11.8	41,741	38.2	54,574	50.0	109,232
50,000-100,000	16,697	20,114	56,852	7,233	6,854	6.8	52,401	52.0	41,641	41.2	100,896
Over 100,000	644,341	164,311	346,945	19,010	281,218	23.9	338,225	28.8	555,164	47.3	1,174,607

Note: Returns for Georgia and Virginia being incomplete, totals estimated in order to obtain national totals.

Rural Sanitation

Rural needs include repairs to existing water supplies or development of new supplies, mostly wells, for more than 6,000,000 homes where facilities are either wholly lacking or are insanitary. This will cost over 800 million dollars. Some 6,000,000 homes also need either new sanitary privies or important repairs to existing ones. This will require almost 400 million dollars. About 1,700,000 homes that have indoor plumbing but cannot be served by community sewer systems, require either new individual systems for disposal of household sewage or repairs to existing systems. The cost of these facilities will be almost $400,000,000.

Previous Survey

A previous survey of sanitation needs was made by the U. S. Public Health Service in 1943, but because of the war, it was not possible to do more than use data on file in Washington. In the present inventory, trained sanitary engineers obtained first hand information by making actual field surveys.

The current inventory is not based on an idea of providing a uniform type of service everywhere. It takes into account the fact that local desires, customs and practices, policies of State and local health agencies, and economic status of the community cause variations in needs.

The accompanying tables show the population and dollar data (by states) on which the report is based. Tables II and III show the breakdown of the needs according to facilities and stage of planning.

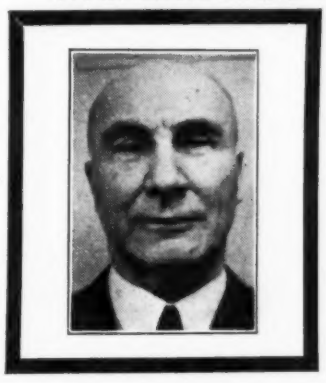
TABLE III

Sewage Works Needs
Estimated Cost of Various Elements and Status of Projects by States and Size of Community

State	Sewers $1,000's	Treatment $1,000's	Miscellaneous $1,000's	Ready for Construction $1,000's	Ready for Construction Pct.	Planning in Progress $1,000's	Planning in Progress Pct.	Projects for Future $1,000's	Projects for Future Pct.	Total Costs $1,000's
Alabama	15,502	15,538	131	2,884	9.3	4,992	16.0	23,295	74.7	31,171
Arizona	6,938	3,885	16	1,432	13.2	1,550	14.3	7,857	72.5	10,839
Arkansas	13,344	12,747	65	204	0.8	2,198	8.4	23,754	90.8	26,156
California	74,225	57,355	1,182	3,037	2.3	96,927	73.1	32,798	24.6	132,762
Colorado	4,404	6,043	....	63	0.7	2,002	19.3	8,382	80.0	10,447
Connecticut	24,236	14,958	....	6,455	16.5	16,740	42.7	15.999	40.8	39,194
Delaware	4,540	3,485	2	75	.9	3,538	44.1	4,414	55.0	8,027
District of Columbia	9,338	1,815	75	860	7.7	2,748	24.5	7,620	67.8	11 228
Florida	45,798	26,804	786	3	0.0	34,518	47.0	38,867	53.0	73,388
Georgia	28,043	19,886	121	4,531	9.4	7,566	15.7	35,953	74.9	48,050
Idaho	6,775	5,153	....	440	3.7	1,250	10.5	10,238	85.8	11,928
Illinois	190,301	46,201	34	34,728	14.7	74,573	31.6	127,235	53.7	236,536
Indiana	56,794	34,474	41	17,327	18.9	29.730	32.6	44,252	48.5	91,309
Iowa	34,825	29,827	1,590	2,188	3.3	12,914	19.5	51,140	77.2	66,242
Kansas	32,847	17,040	94	784	1.6	8,020	16.0	41,177	82.4	49,981
Kentucky	22,443	17,496	471	1,395	3.7	9,343	23.1	29,672	73.2	40,410
Louisiana	23,964	12,847	845	3,577	9.5	6,267	16.7	27,812	73.8	37,656
Maine	11,937	8,022	29	198	1.0	806	4.0	18,984	95.0	19,988
Maryland	34,731	8,875	....	2,760	6.3	22,472	51.4	18,374	42.3	43,606
Massachusetts	42,503	25,023	2,732	8,773	12.5	20,260	28.8	41,225	58.7	70,258
Michigan	111.146	37,499	4,451	43,574	28.4	73,698	48.2	35,824	23.4	153,096
Minnesota	36,810	19,413	29	3,596	6.4	13,537	24.1	39,119	69.5	56,252
Mississippi	11,293	9,488	111	1,524	7.3	8,134	38.9	11,234	53.8	20,892
Missouri	57,941	62,161	30	22,976	19.1	15,677	13.6	81,479	67.3	120.132
Montana	4,519	4,231	15	247	2.8	2,717	31.0	5,801	66.2	8,765
Nebraska	13,183	14,517	1,311	523	1.8	4,409	15.2	24,079	83.0	29,011
Nevada	1,339	860	5	181	8.2	110	5.0	1,913	86.8	2,204
New Hampshire	4,140	6,025	....	0	0	0	0	10,165	100.0	10,165
New Jersey	88,120	60,567	709	8,684	5.8	59,313	39.7	81,399	54.5	149.396
New Mexico	4,842	6,298	7	396	3.6	1,344	12.1	9,407	84.3	11,147
New York	905,051	195,094	158	110,416	10.0	89,865	8.2	900,022	81.8	1,100,303
North Carolina	25,201	39,674	535	8,998	13.7	14,887	22.8	41,525	63.5	65,410
North Dakota	7,417	4,707	3	795	6.5	2,549	20.9	8,783	72.6	12,127
Ohio	59,895	75,974	1,137	24,654	18.0	46,078	33.5	66,274	48.5	137,006
Oklahoma	17,351	18,902	23	1,242	3.4	13,366	36.8	21,668	59.8	36,276
Oregon	17,386	12,564	....	21	0.1	18,492	61.5	11,437	38.4	29,950
Pennsylvania	209,082	131,516	351	9,396	2.8	76,586	22.4	254,967	74.8	340,949
Rhode Island	6,015	2,902	....	0	0	2,650	29.7	6,267	70.3	8,917
South Carolina	12,578	9,879	27	6,663	29.8	3,293	14.7	12,528	55.5	22,484
South Dakota	4,777	5,524	....	130	1.2	921	8.9	9,250	89.9	10,301
Tennessee	33,075	17,047	128	123	0.2	7,627	15.2	42,500	84.6	50,250
Texas	47,097	31,176	767	8,856	11.2	20,769	26.2	49,415	62.6	79,040
Utah	18.343	9,390	....	3,617	13.0	3,490	12.6	20,626	74.4	27,733
Vermont	1,444	2,824	29	0	0	295	6.9	4,002	93.1	4,297
Virginia	28,285	22,844	195	3,467	6.8	16,490	32.2	31,367	61.0	51,324
Washington	28,141	17,360	115	5,292	11.6	19,591	42.8	20,733	45.6	45.616
West Virginia	33,188	30,068	252	838	1.3	16,211	25.5	46,459	73.2	63,508
Wisconsin	26,693	11,496	136	2,531	6.7	17,310	45.3	18,484	48.0	38,325
Wyoming	2,087	2,714	....	55	1.2	225	4.6	4,521	94.2	4,801
Total	2,499,927	1,230,188	18,738	360,509	9.6	908,048	24.2	2,480,296	66.2	3,748.853
Size of Community										
200- 500	160,477	103,229	266	1,227	0.5	15,128	5.7	247,617	93.8	263,972
500- 1,000	133,817	84,059	587	10,291	4.7	34,685	15.9	173,487	79.4	218,463
1,000- 5,000	307,352	249,502	1,828	31,276	5.6	105,933	18.9	421,473	75.5	558,682
5,000- 10,000	116,996	101,431	1,238	22.435	10.2	74,125	33.8	123,105	55.0	219,665
10,000- 25,000	120,921	114,643	1,930	31,388	13.2	88,789	37.4	117,317	49.4	237,494
25,000- 50,000	90,015	70,061	1,026	19,861	12.3	58,404	36.2	82,837	51.5	161.102
50,000-100,000	96,035	79,272	1,919	6,244	3.5	92,958	52.5	78,024	44.0	177,226
Over 100,000	1,474,314	427,991	9,944	237,787	12.4	438,026	22.9	1,236,436	64.7	1,912,249

Note: Returns for Georgia and Virginia being incomplete, totals estimated in order to obtain national totals.

W. S. Lea Passes



William S. Lea, well known Consulting Engineer of Montreal, Canada, died suddenly on July 5, 1947, at his country home in Senneville, Quebec. That he was in his 70th year will astound many who knew him.

Born at Victoria, Prince Edward Island, in 1877, he was educated at Prince of Wales College and McGill University, graduating in 1908 with honors. In his early engineering work he was associated with the late Freeman C. Coffin and the late Frank A. Barbour of Boston. He was at one time a lecturer in Municipal Engineering at McGill University and later became Engr. in Charge of the Dept. of Water Supply for Vancouver, B. C.

In 1913 with his brother he established the partnership of R. S. and W. S. Lea, Consulting Engineers, which continued until the retirement of R. S. Lea in 1930. For nine years Mr. Lea served on the Montreal Sewers Commission and was Consulting Engineer on the Commission's $20,000,000 trunk sewer construction program. He was also Consulting Engineer to Winnipeg, Manitoba, in the design and construction of trunk sewers and a 25 mgd. treatment works costing $4,000,000. In addition to these projects Mr. Lea served many municipalities and industries in Canada from coast to coast, and enjoyed a high reputation in the engineering field.

N. Y. Section Planning "Little Convention" in Plattsburg

Special Invitation Being Extended to Canadians and New Englanders

The accompanying air view from above Lake Champlain, New York, shows the famed Hotel Champlain of Plattsburg, N. Y., where the Fall meeting of the N. Y. State Section of AWWA is to be held September 4th and 5th.

Realizing that the majority of water works men in the east and northeast would be unable to attend the AWWA convention in San Francisco, the officers of the N. Y. Section decided to plan something of a "Miniature Convention" in the Fall at some resort spot.

Not only is this meeting being arranged for New Yorkers, but also for all water works men in Eastern Canada and New England. We have been asked by the New York Section to publicize the fact that *all* water works men who may care to attend the "Little Convention" in Plattsburg, N. Y., Sept. 4th and 5th, are cordially invited to come, regardless of whether they are members of AWWA or not. This we are glad to do and again wish to call the reader's attention to the attractive meeting place—Hotel Champlain on the Lake.

West Virginia Sewage and Industrial Wastes Ass'n Organized

The West Virginia Sewage and Industrial Wastes Association was organized at a meeting held in Charleston, W. Va., June 20, 1947. A total of 66 registered for the organizational meeting, presided over by Dr. D. V. Moses of E. I. du Pont de Nemours Co. Francis S. Friel, President of the Sewage Works Federation, and W. H. Wisely, Exec. Secy. of the Federation, were in attendance to explain the workings of the Federation, to which the West Virginia Association has applied for affiliation.

The following were elected officers:

President—Kyle Bruce, Supt., Bluefield Sanitary Board, Bluefield, W. Va.

First Vice Pres.—P. D. Simmons, Chemist, Weirton Steel Co., Weirton, W. Va.

Second Vice Pres.—J. E. Settle, Consulting Engr., Charleston, W. Va.

Natl. Director—Kenneth S. Watson, Engr., State Water Commission, Charleston, W. Va.

Secy.-Treas.—R. G. McCall, Assoc. Engr., W. Va. Dept. of Health, Charleston, W. Va.

A showing of "Clean Waters" completed the program. A fall meeting will be held at a time and place to be designated soon.

A. E. Clark Heads Suburban Utility District in Nashville

A. E. Clark, whose series of articles on "Operation of Small Filtration Plants" begins in this issue of *Water & Sewage Works* has been appointed General Manager of the Nashville Suburban Utilities District, Nashville, Tenn.

A graduate of Vanderbilt University, Mr. Clark has had a varied experience to fit him for his new position. For seven and one half years Mr. Clark was Assoc. San Engr. in charge of public water supplies for the Tennessee State Dept. of Health. This was followed by a tour of duty as travelling engineer for the Public Works Administration. During the war, Mr. Clark was Water Supply Engineer, of the Hercules Powder Co. at the Volunteer Ordnance Works. Until his recent appointment, Mr. Clark was connected with the Department of Public Works of Nashville.

Florida's Committee on Water Supply and Sewerage Education

Thos. Paul, Pres., Fla. Water and Sewage Works Assn., Bradenton; C. D. Williams, Univ. of Florida, Gainesville; J. R. Hoy, Secy.-Treas., Fla. Sewage Works Assn., Jacksonville; A. P. Black, Univ. of Fla., Gainesville; G. M. Turner, Genl. Extension Div., Univ. of Fla.; David B. Lee, Chief Engr., Fla. State Board of Health, Jacksonville (Committee Chairman); Harry T. Oberly, Chm., Fla. Section of AWWA, St. Petersburg.

(This committee, representing varied interests, arranges the Florida Annual Short Courses in Water Supply and Sewerage, the 15th of which was held at the Univ. of Florida only recently.)

STILL MORE WATER AND SEWAGE WORKS PROJECTS

Federal Loans Made Between March 17 and July 1 for Construction Plans

TWO years ago this month, *Water & Sewage Works* (then *Water Works & Sewerage*) published the first listing of water and sewage works projects for which the Federal government had made loans for the preparation of construction plans.

With this present listing covering the period of Mar. 17 to July 1, of this year there have been published eight such lists. The present list contains 426 projects in 334 communities in 44 states. The following summary shows the number of projects as they have been published.

Issue of W. & S. W.	No. of Projects	No. of Communities
Aug., '45	77	61
Sept., '45	122	100
Nov., '45	206	165
Apr., '46	629	526
Aug., '46	423	346
Nov., '46	339	304
Apr., '47	381	322
Aug., '47	427	326
Total to date	2,604	2,150

The funds for these plans are made available through the Bureau of Community Facilities of the Federal Works Agency and are to be repaid when construction is begun. According to the F.W.A., as of April 30 of this year, the total value of these projects for which loans have been made was $934,803,497, and at that time the total value of the applications received was in excess of $1,261,000,000. Most of the loans included in the following list had not been made as of April 30, and therefore it may well be assumed that loans have now been made for construction plans calling for more than one billion dollars worth of construction of water and sewage works.

The following list shows the communities receiving the most recent loans and the estimated cost of the completed projects.

Community and Facility	Estimated Cost
Alabama	
Bessemer (water)	$ 179,000
Butler (water)	36,500
Monroeville (sewage)	105,000
Russellville (sewage)	77,565
Russellville (sewage)	53,015
Selma (sewage)	110,350
Arizona	
Globe (water)	116,450
Globe (water)	57,500
Prescott (sewage)	32,600
Tucson (sewage)	250,000
Arkansas	
Brinkley (water)	164,477
Brinkley (sewage)	169,017
Batesville (sewage)	349,767
Cabot (sewage)	100,000
Camden (sewage)	520,611
Danville (sewage)	106,604
Dierks (sewage)	108,300
Dierks (water)	95,000
Dierks (sewage)	217,172
Eureka Springs (water)	38,490
Greenwood (sewage)	58,960
Marked Tree (sewage)	108,600
Marmaduke (sewage)	90,558
Lepanto (water)	27,350
Lepanto (sewage)	27,350
Pine Bluff (sewage)	1,039,300
Siloam Springs (water)	51,445
Siloam Springs (sewage)	63,809
Texarkana (sewage)	102,280
Trumann (sewage)	72,460
Trumann (water)	189,600
California	
Belvedere (sewage)	172,800
Corona (sewage)	186,000
El Monte (sewage)	39,500
Glenwood (sewage)	19,219
Glenwood (sewage)	14,422
Glenwood (sewage)	13,811
Glenwood (sewage)	128,411
Gustine (sewage)	186,200
Madera (sewage)	248,000
Menlo Park (sewage)	534,000
Palo Alto (sewage)	24,990
Redondo (sewage)	463,440
Redondo (sewage)	460,840
Redondo Beach (sewage)	426,000
Sacramento (water)	144,192
Sacramento (sewage)	81,500
Sacramento (sewage)	29,185
Solana Beach (sewage)	149,133
Sonoma (sewage)	108,000
Tiburon (sewage)	120,000
Ukiah (water)	194,300
Willits (sewage)	57,000
Colorado	
Aspen (sewage)	130,000
Leadville (sewage)	225,000
Monte Vista (sewage)	111,000
Delaware	
Laurel (sewage)	285,000
Seaford (water)	639,000
Seaford (sewage)	963,000
Seaford (sewage)	607,000
Wilmington (sewage)	5,480,000
Florida	
New Smyrna (sewage)	143,000
Georgia	
Brunswick (water)	32,249
Cordele (sewage)	260,200
Cordele (sewage)	271,860
Dacula (water)	40,000
Douglas (water)	46,000
Eatonton (water)	35,025
Gainesville (water)	168,300
Palmetto (sewage)	128,500
Rossville (sewage)	141,515
Idaho	
Bancroft (sewage)	41,400
Bancroft (sewage)	25,400
Buhl (sewage)	100,000
Crairmont (sewage)	67,100
Lewiston (sewage)	359,000
Lewiston (sewage)	64,500
Lewiston (sewage)	103,200
Lewiston (sewage)	141,500
Lewiston (water)	453,000
Pexburg (sewage)	79,000
Illinois	
Bloom Township (sewage)	267,099
Buckner (sewage)	97,000
Leaf River (sewage)	62,000
West Salem (water)	185,000
Indiana	
Brookville (sewage)	68,000
Fowler (sewage)	131,809
Fremont (sewage)	161,650
Lawrence (sewage)	1,010,000
Martinsville (sewage)	149,500
Mathews (water)	93,300
Mooresville (sewage)	71,000
Iowa	
Audubon (sewage)	30,000
Audubon (sewage)	70,000
Clover Hills (sewage)	50,700
Coralville (sewage)	86,750
Council Bluffs (sewage)	85,009
Council Bluffs (sewage)	43,621
Council Bluffs (sewage)	52,080
Council Bluffs (sewage)	67,085
Council Bluffs (sewage)	42,995
Council Bluffs (sewage)	14,465
Council Bluffs (sewage)	38,555
Council Bluffs (sewage)	157,233
Council Bluffs (sewage)	510,473
Council Bluffs (sewage)	108,674
Council Bluffs (sewage)	42,993
Council Bluffs (sewage)	374,090
Council Bluffs (sewage)	95,565
Council Bluffs (sewage)	1,006,068
Creston (water)	180,000
Elkhart (water)	32,205
Floyd (water)	38,358
Town of Fontanelle (sewage)	115,630
Garden Grove (water)	53,531
George (sewage)	85,000
Gravity (sewage)	69,252
Gravity (water)	69,296
Greeley (water)	49,200
Hastings (water)	38,928
Iowa City (sewage)	58,800
Malvern (sewage)	40,853
Malvern (sewage)	13,820
Malvern (water)	14,791
Milford (sewage)	44,000
Murray (sewage)	79,761
Murray (water)	128,287
Murray (water)	128,287
Minden (sewage)	51,439
Minden (water)	18,382
Postville (sewage)	45,200
Rutland (water)	40,170
Sloan (sewage)	78,900
Story City (sewage)	78,500
Story City (sewage)	44,000
Story City (sewage)	64,800
Tingley (water)	39,300
Town of Silver City (water)	40,055
Kansas	
Allen (water)	19,700
Greeley (water)	35,700
Melvern (water)	27,300
Richmond (water)	38,693
Topeka (water)	32,000
Troy (sewage)	50,417
Troy (water)	29,025
Kentucky	
Butler (water)	25,076
Williamstown (sewage)	137,088
Louisiana	
Cottonport (water)	48,298
Cottonport (sewage)	79,165
Cottonport (sewage)	19,180
Farmerville (sewage)	170,000
Jennings (sewage)	159,023
Jennings (sewage)	87,878
Jennings (sewage)	81,475
Tallulah (sewage)	273,547
West Lake (water)	99,827
Maine	
Patten (water)	222,950
Massachusetts	
Brewster (water)	225,000
Bridgewater (sewage)	192,000
Burlington (water)	236,000
Byfield (water)	160,000
East Hampton (sewage)	44,861
East Hampton (sewage)	314,810
East Hampton (sewage)	117,014
Fall River (sewage)	1,037,000
Littleton (water)	250,000
Lowell (water)	768,000
Marblehead (sewage)	184,500
Newburyport (water)	24,500
Southbridge (sewage)	184,800
Southbridge (sewage)	294,550
Westfield (sewage)	470,000
Michigan	
Almont (sewage)	104,750
Holly (sewage)	63,000
Holly (sewage)	100,000
Kalamazoo (sewage)	525,187
Landel (sewage)	529,100
Landel (water)	529,100
St. Louis (sewage)	127,800
Minnesota	
Cannon Falls (sewage)	151,286
Cass Lake (sewage)	172,170
Deephaven (water)	564,418
Deer River (sewage)	88,500

Community and Facility	Estimated Cost
Duluth (sewage)	266,186
Duluth (sewage)	150,054
Duluth (sewage)	23,403
Erskine (sewage)	67,800
Erskine (sewage)	44,850
Golden Valley (sewage)	246,800
Golden Valley (water)	170,480
Greenbush (sewage)	74,134
Henderson (sewage)	197,128
Janesville (sewage)	111,000
Janesville (sewage)	69,000
Janesville (water)	63,000
Kenyon (sewage)	145,000
Kenyon (sewage)	151,500
Lancaster (sewage)	61,000
Le Center (sewage)	151,633
Melrose (sewage)	320,450
Minneota (sewage)	41,900
Minneota (sewage)	25,500
Minneota (sewage)	54,700
New London (water)	67,835
New Richland (sewage)	24,601
Richfield (sewage)	4,180,798
Robbinsdale (sewage)	53,200
Robbinsdale (sewage)	106,500
Robbinsdale (sewage)	99,800
Robbinsdale (sewage)	142,500
Storden (sewage)	40,000
Storden (sewage)	20,800
Storden (sewage)	12,200
Truman (sewage)	108,000
Ulen (sewage)	69,653
Walnut Grove (sewage)	66,100
Mississippi	
Affton Sanitary Sewer District (sewage)	65,391
Brookhaven (water)	185,000
D'Lo (water)	21,500
Grace (sewage)	56,400
Grace (sewage)	29,100
Verona (sewage)	50,500
Verona (water)	64,500
Missouri	
Bolivar (water and sewage)	130,064
Odessa (sewage)	99,452
Oregon (sewage)	101,150
Montana	
Great Falls (sewage)	90,300
Nebraska	
Aurora (sewage)	33,151
Benkelman (sewage)	44,400
Benkelman (water)	47,347
Cairo (sewage)	62,838
Cairo (water)	19,223
Grand Island (sewage)	38,312
Grand Island (sewage)	141,081
Grand Island (sewage)	61,960
Grand Island (sewage)	93,382
Hebron (water)	92,477
Niobrara (sewage)	54,796
Plymouth (sewage)	57,275
Scribner (water)	38,086
Sutherland (sewage)	68,270
New Hampshire	
Hampton (sewage)	178,550
New Jersey	
Woodbine (sewage)	180,000
New Mexico	
Hatch (sewage)	62,000
Mosquero (sewage and water)	47,340
Taos (water)	89,000
Wagon Mound (sewage)	60,000
New York	
Bolton (sewage)	385,346
Cicero-South Bay (water)	155,000
Elmira Heights (sewage)	425,500
Elmira (sewage)	862,500
Vestal (sewage)	345,859
North Carolina	
Burlington (water)	640,000
Burlington (water)	142,000
Burlington (water)	230,000
Burlington (water)	286,000
Burlington (sewage)	333,000
Burlington (sewage)	88,000
Burlington (sewage)	113,000
Burlington (sewage)	271,000
Charlotte (sewage)	1,253,084
Concord (sewage)	1,238,548
Elm (sewage)	14,980
Jamesville (water)	37,450
Leaksville (water)	208,000
Mayodan (sewage)	58,849
Roper (water)	54,670
Wadesboro (sewage)	90,000
North Dakota	
Bowbells (sewage)	24,000
Bowbells (sewage)	20,500
Bowbells (water)	60,000
Cavalier (sewage)	68,800
Cavalier (sewage)	38,000
Cavalier (sewage)	72,000
Cavalier (water)	134,400
Cogswell (water)	65,000
Grand Forks (sewage)	66,160
Leeds (sewage)	35,600
Mayville (sewage)	81,600
New Rockford (sewage)	118,000
Southwest Fargo (water)	76,000
Stanley (water & sewage)	60,050
West Fargo (sewage)	108,000
Williston (water)	246,300
Williston (water)	49,500
Wyndmere (water)	75,731
Wyndmere (sewage)	58,551
Wyndmere (sewage)	27,100
Ohio	
Castalia (water)	6,150
Conneaut (sewage)	221,115
Conneaut (sewage)	402,260
Dayton (sewage)	821,000
Dennison (sewage)	481,000
Edison (water)	67,294
Lakemore (sewage)	160,000
Lexington (sewage)	125,225
Manchester (sewage)	241,000
McDonald (sewage)	179,700
Milford Center (sewage)	95,000
Ottoville (water)	68,019
Powhatan Pt. (sewage)	200,400
Richmond (water)	49,830
Seaman (sewage)	150,000
Shiloh Springs (water)	254,500
Spencer (sewage)	82,000
Van Buren Township (sewage)	307,590
Waynesfield (sewage)	85,000
West Union (sewage)	231,000
Oklahoma	
Clinton (sewage)	214,752
Oregon	
Canby (sewage)	301,434
Coos Bay (sewage)	268,600
Fairview (sewage)	56,100
Glendale (water)	22,000
Independence (sewage)	130,000
Junction City (sewage)	203,000
Mt. Angel (sewage)	55,000
Oakland (sewage)	193,000
Oakridge (sewage)	139,500
Portland (sewage)	800,000
Riddle (water)	23,500
Sutherlin (sewage)	175,500
Troutdale (sewage)	66,600
Woodburn (sewage)	173,100
Pennsylvania	
Allentown (water)	1,980,000
Avis (sewage)	152,000
Belle Vernon (sewage)	348,000
Brownsville (sewage)	478,200
Catasaugua (sewage)	584,000
California (sewage)	139,080
Canton (sewage)	314,155
Charleroi (sewage)	495,550
Clearfield (sewage)	223,000
Clearfield (sewage)	248,000
Clearfield (sewage)	329,000
Corn Planter (sewage)	166,000
Cressona (sewage)	266,074
Curwensville (sewage)	225,000
Danville (sewage)	212,000
Florence (water)	220,330
Ford City (sewage)	553,000
Greenville (sewage)	194,650
Glen Rock (sewage)	215,000
Harrisville (water)	86,283
Hazleton (sewage)	1,130,500
Johnstown (sewage)	1,438,470
Lackawanna Township (sewage)	223,700
Lehighton (sewage)	1,120,000
Matamoras (sewage)	338,473
Middleburg (sewage)	177,500
Midland (sewage)	258,100
Millersburg (sewage)	139,699
Milton (sewage)	323,250
Monessen (sewage)	1,068,000
Mt. Wolf (sewage)	238,836
New Eagle (sewage)	125,000
Norristown (sewage)	1,011,275
N. Charleroi (sewage)	143,790
North York (sewage)	188,770
Pleasantville (sewage)	23,910
Plymouth (sewage)	540,000
Plymouth Township (sewage)	250,000
Shillington (sewage)	694,397
Springetsbury (sewage)	248,642
Steelton (sewage)	284,750
Titusville (sewage)	266,413
Taylor (sewage)	545,000
Township of Upper Southhampton (water)	137,040
Wormleysburg (sewage)	119,950
Wyalusing (sewage)	282,000
Wyalusing (sewage)	32,675
Wyoming (sewage)	299,200
South Carolina	
Port Royal (sewage)	109,500
South Dakota	
Clark (sewage)	66,076
Clear Lake (sewage)	42,885
Hayti (sewage)	48,550
Kadoka (water)	116,440
Plankington (sewage)	82,000
Tennessee	
Alexandria (water)	59,000
Madisonville (sewage)	118,000
Texas	
Avinger (water)	121,982
Bangs (sewage)	65,000
Baytown (sewage)	72,000
Baytown (sewage)	50,000
Baytown (water)	52,000
Brookshire (water)	85,000
Brookshire (sewage)	70,000
Buffalo (sewage)	56,100
Centerville (sewage)	51,100
Corpus Christi (sewage)	1,840,000
Dickinson (sewage)	41,000
Dickinson (sewage)	111,000
Dickinson (water)	152,000
Falls City (water)	60,500
Galveston (sewage)	1,340,000
Harris County (sewage)	97,500
Houston (water & sewage)	925,766
La Marque (sewage)	48,000
La Marque (sewage)	51,000
La Marque (water)	21,500
La Marque (water)	39,000
La Porte (sewage)	518,500
La Villa (water & sewage)	123,066
Lexington (sewage)	44,000
Lufkin (sewage)	189,500
Madisonville (water & sewage)	130,000
Port Lavaca (sewage)	99,000
Rogers (sewage)	59,000
Taylor (sewage)	26,960
Taylor (sewage)	21,830
Texarkana (sewage)	85,200
Troup (water & sewage)	69,000
West Texas (water)	26,800
Wharton (water)	51,952
Whitney (water & sewage)	50,000
Willis (sewage)	70,000
Vermont	
Lurenburg (water)	53,550
Montpelier (sewage)	136,300
Virginia	
Franklin (sewage)	289,500
Norfolk County (sewage)	69,500
Washington	
Greenwood Ave. (sewage)	1,223,000
Ridgefield (sewage)	86,900
West Virginia	
War (sewage)	197,598
Wisconsin	
Hartford (sewage)	188,625
Independence (sewage)	77,000
Mt. Hope (water)	30,000
Spring Valley (sewage)	139,000
Turtle Lake (sewage)	120,870
Wyoming	
Baggs (sewage)	39,050
Baggs (water)	27,500
Gillette (water)	109,000
Thermopolis (sewage)	134,000

Alabama-Mississippi Section Organized

Late in May, at Birmingham, Ala., an Alabama-Mississippi Section of the A.W.W.A. was organized. Eighty-seven members and guests attended the meeting, which was presided over by A. Clinton Decker, Sanitary Engineer of the Tennessee Coal, Iron and Railroad Co. of Birmingham. Wendell R. LaDue, President of A.W.W.A., and Harry E. Jordan, Secretary, attended the meeting and participated in the organization of the new Section.

Most of the members of this new Section were formerly associated with the Southeastern Section. The new officers elected at this meeting were Chairman, Arthur N. Beck, Engr. & Dir. Bureau of Sanitation, State Dept. of Public Health, Montgomery, Ala.; Vice-Chairman, Baxter F. Wade, Supt., Jackson, Miss.; Secretary-Treasurer, John L. Snow, Distr. Engr., Layne-Central Company, Montgomery, Ala.; Trustee, M. A. Kroeze, Dir. of Div. of Sanitary Eng., Mississippi State Board of Health, Jackson, Miss.; A.W.W.A. Director, A. Clinton Decker, Sanitary Engineer, Tennessee Coal, Iron and Railroad Co., Birmingham, Ala.

BIOFILTRATION EXPERIENCES AT COLUMBIA (S.C.) ARMY AIR BASE

By JAMES M. BROWN*
MT. VERNON, N. Y.

THE Columbia Army Air Base, Columbia, So. Car., located about ten miles west of the city of Columbia, was built in 1942. The biofiltration type of sewage treatment was chosen because of its ability to yield a final effluent of substantially uniform character, despite wide variations in the volume and composition of the raw sewage. The plant is situated along a small creek of variable flow which during dry periods has a flow of less than 0.8 cfs. (500,000 gpd.) and during storms has a flood flow of more than 30 cfs. A 12-inch wooden Parshall flume was constructed by plant personnel in the bed of the stream to measure the stream flow. The stream normally flows in a shallow bed for about ¾ mile to a small pond which has been used by sportsmen about Columbia for recreational purposes.

Description of Plant

The plant consists of a 1½ inch bar screen, a 9 inch Parshall flume, a wet well with four Fairbanks-Morse vertical centrifugal pumps which pump the raw sewage to a circular primary clarifier against a head of 21 feet, where it flows by gravity to a high rate trickling filter followed by a secondary circular clarifier. Recirculation of the final effluent back to the wet well was automatically accomplished by a hydraulic regulating valve so as to keep a constant water level in the wet well, regardless of the incoming flow of raw sewage resulting in a constant flow throughout the plant.

Sludge from both clarifiers and skimmings from the grease pit, collecting floating grease from the top of the primary clarifier, was pumped to the floating cover digester having a design capacity of 3.8 cu. ft. per person. Both clarifiers were equipped with Dorr sludge collecting mechanisms; the primary with a rotary arm with a canvas blade which continually scrapes the floating grease and scum to the skimming tank. Each clarifier had a detention period of 1¾ hours, based on a design load of 7,500.

The Base's water supply was limited, coming from the city's supply by means of a special line of limited size. Water conservation programs produced a strong sewage as indicated in Table I. Pounds of B.O.D. per capita averaged 0.16 lb., which is of the same magnitude as municipal sewage, but suspended solid values of 0.15 lb. per capita were noticeably lower than those found in municipal sewage, nevertheless was in line with those reported recently in a report on Sewage Treatment at Military Installations in *Sewage Works Journal*, where the average suspended solid rate from 34 camps amounted to 0.154 lb. per capita. The reason why Army suspended solids rates should be lower than municipal sewage does not seem apparent. The flow from the Base was not like many other Army posts but consisted of a

Table I

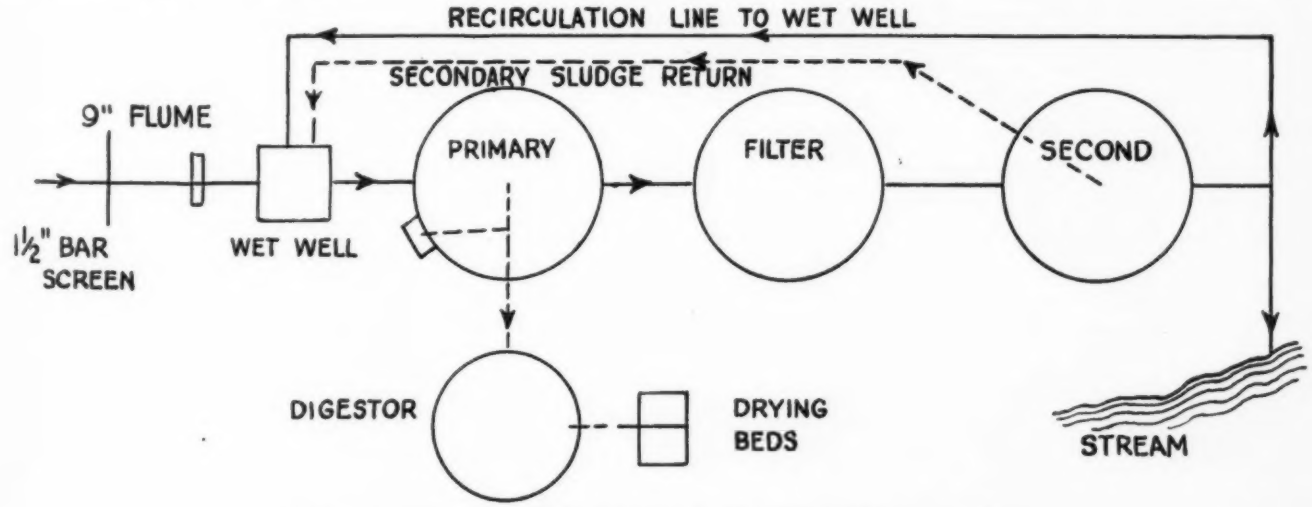
DATA ON PLANT OPERATION

Month	Avg. flow gals. daily	Recir. rate	B.O.D. ppm. Raw	B.O.D. ppm. PC	B.O.D. ppm. Filt	B.O.D. ppm. Final	Susp. solids ppm. Raw	Susp. solids ppm. PC	Susp. solids ppm. Filt	Susp. solids ppm. Final
April	240,000	5:1	540	135	107	83	...	...	...	...
May	270,000	4:1	376	184	103	87	...	...	...	...
June	310,000	3:1	337	182	97	73	239	77	70	37
July	320,000	3:1	322	138	79	58	256	93	77	43
August	380,000	2½:1	356	190	101	65	252	97	84	53
Sept.	340,000	3:1	381	182	106	70	264	104	81	55
Oct.	320,000	2½:1	434	195	119	77	255	93	70	50
Nov.	400,000	2:1	404	186	112	72	259	91	68	48

Month	Percent removal B.O.D.	Percent removal Susp. sol.	Raw Sewage lb. B.O.D./cap.	Lb. SS/cap.	Cu. ft. gas/cap.
April	84.6	...	...	...	*
May	76.5	...	...	...	*
June	78.5	...	0.15	0.14	1.2
July	82.0	82.8	0.16	0.15	1.3
August	81.8	79.0	0.15	0.14	1.3
Sept.	81.7	79.2	0.17	0.16	1.3
Oct.	82.4	80.4	0.16	0.13	1.2
Nov.	82.1	80.8	0.17	0.13	1.2

*Gassing started 8 weeks after operation.

*Formerly Assoc. San. Engr., Columbia Army Air Base, Columbia, S. C.



Flow Diagram of Columbia Army Air Base Sewage Treatment Plant

Secondary Clarifier—Pump House; Parshall Flume in Rear
Clarifier dia.—43 ft. Det. Time 1¾ hr. at 500,000 gpd.

rather regular flow from 6 A. M. to 8 P. M., a dropping off after that until midnight, when very little flow (5 per cent of peak daytime load) entered the plant until 6 A. M. This appears to be true of many Air Bases where a "round the clock" schedule is maintained, in contrast to the reveille-retreat program carried on at most other type Army posts.

The filter 43 ft. in diameter and 7 ft. 6 in. deep was equipped with a Dorr reaction type arm and is deeper than most filters of this type, but even with the high loadings of 25-35 mil. gal. per acre per day, no ponding difficulties were experienced. Perhaps, the high recirculation rate helped in keeping the strength of the sewage applied to the filter low enough so that the filter could adequately care for the organic load. Loadings for the first eight months of operation averaged 2.8 lb. of B.O.D. per cubic yard of stone. Loadings as high as 3.6 lb. for extended periods seemed to have no detrimental effect on the operation of the filter. Short breakdowns due to power failures which prevented the filter from being dosed seemed to have a marked effect on B.O.D. removal and cut down considerably on the efficiency of the filter for rather extended periods.

A Problem of Sludge Pumping

It was not long after the plant was put into operation in February 1943 that several headaches were discovered. It was noticed that the water level in the primary clarifier was at a higher level than the normal level of the water in the digester, consequently sewage from the clarifier siphoned into the digester by gravity when valves were not closed tightly. This peculiar elevation differential prevented sludge from being pumped from the clarifiers at a low rate. This high pumping rate yielded a low solid concentration in the sludge being pumped and therefore added to the amount of supernatant liquor that had to be returned to the wet well. Table II indicates typical sludge solid concentrations computed from daily composite samples.

Table II
Solid Content of Sludge Samples

	Primary	Secondary
	Percent	
4 Mar.	3.2	2.4
5 Mar.	3.9	2.9
6 Mar.	3.8	2.6
7 Mar.	3.9	3.0
8 Mar.	4.1	2.4
9 Mar.	3.2	2.7
10 Mar.	3.4	2.2

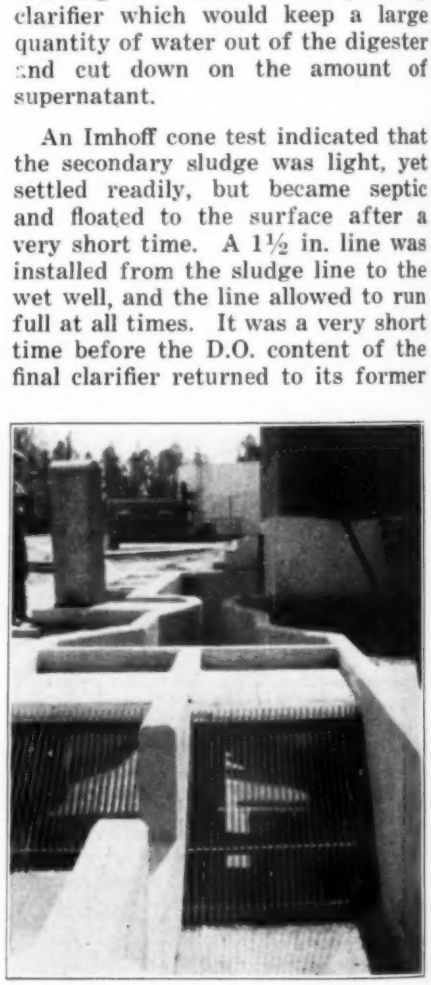
The plant seemed capable of taking this increased amount of supernatant because of the size of the digester, the ability to increase the rate of recirculation and the ability of the plant to treat this supernatant during periods of low sewage flow. Supernatant liquor was returned during the six hour period starting at midnight when the raw sewage flow was low, and the supernatant could be diluted with final effluent by recirculation as high as 4 or 5:1. Although this practice wasted power, it was felt that since the Base was not a permanent installation it would be cheaper in the long run than alterations to the raw sludge lines so that higher solid values could be maintained.

A Problem with Secondary Sludge

Difficulty was also experienced in maintaining a high solid content in the secondary raw sludge even where the irregular elevation differential did not exist. The length of the pumping period was shortened, and the length of time between pumping periods lengthened with very little improvement being noted. A short time later a great number of small worms were noticed in the final effluent passing over the overflow weir of the clarifier. Gas bubbles covered the entire surface of the clarifier, and the number of these worms increased.

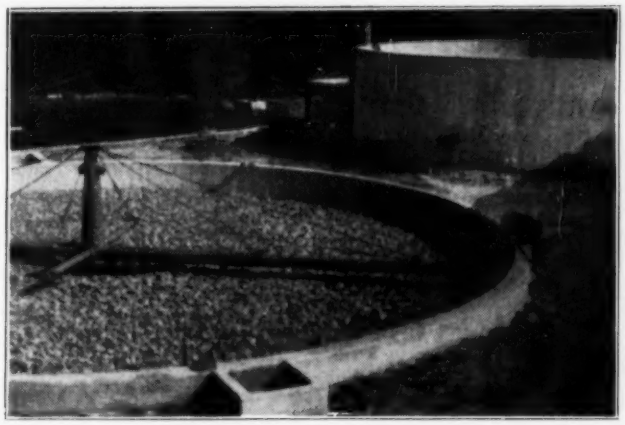
The presence of the gas bubbles indicated a general septic condition existed in the clarifier. The dissolved oxygen content reduced from 3.5 ppm. to 0.0, and the quantity of worms increased noticeably. Since the reason for this condition was no doubt due to the septic condition of the clarifier, and since it appeared impossible to maintain a high solid content in the sludge pumped, the suggestion was made to return this sludge to the wet well by gravity, allowing it to settle in the primary clarifier which would keep a large quantity of water out of the digester and cut down on the amount of supernatant.

An Imhoff cone test indicated that the secondary sludge was light, yet settled readily, but became septic and floated to the surface after a very short time. A 1½ in. line was installed from the sludge line to the wet well, and the line allowed to run full at all times. It was a very short time before the D.O. content of the final clarifier returned to its former



Bar Rack 1-in. Pump House in Rear
9-in. Parshall Flume behind bar rack.

Dorr High Rate Trickling Filter



Filter With Digester in Rear

Filter is 43 ft. in dia., 9 ft. 6 in. deep—Dosage 34 mgad.

value (approx. 3.5 ppm.), and no further evidence of worms in the effluent was noted.

No Filter Fly Problem

During the entire operation of the filter, large numbers of Psychoda fly larvae were visible in the final effluent, even though no serious adult fly problem was experienced. It seemed that the larvae did not progress into the adult fly down stream from the plant, and no doubt the heavy dosing of the filter washed the larvae from the bed before they had time to develop into the adult fly.

Lime in Digester?

The digester equipped with a PFT-Downes floating cover was started the day the plant was started by pumping sewage to the digester through the sludge pumps, until the cover was lifted off its supports to prevent any damage from an explosion. Lime was added periodically to keep the pH at a point near neutrality, but its advantages are questionable for after large additions of lime slurry through the grease skimming tank the pH never remained above 6.7, but yet no foaming or other difficulties were experienced. After these large additions of lime, the pH would rise to 7.2 then in two or three days fall to 6.7. Many writers have reported that the total acidity is more informative as to whether a digester is functioning satisfactorily than the pH, and this seemed to be the case here. Additions of lime were discontinued after six months of operation, and there was no change in the pH. The yield of gas amounted to 1.2 cu. ft. per person. The digested sludge, averaged 49.1 per cent volatile matter, had good drying qualities, no odor and was used throughout Base as soil conditioner.

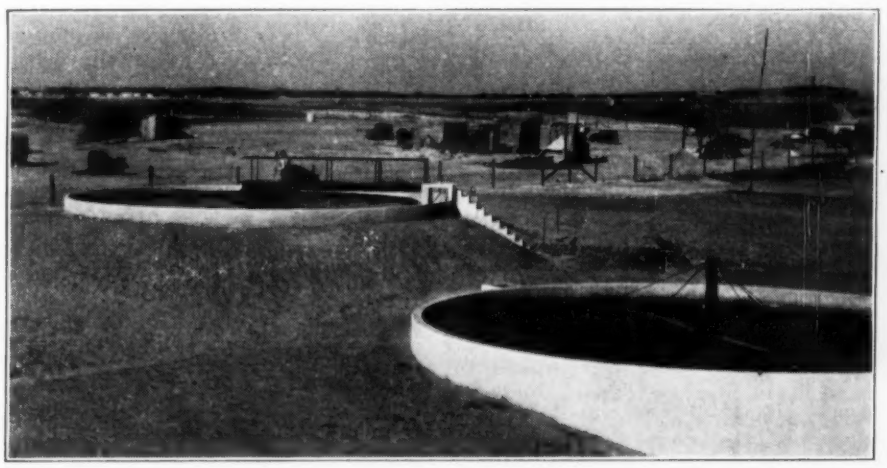
Comment

1. The high-rate filter acts as a "decolloider"; it serves to coagulate the colloidal material and at the same time, there is a reduction in B.O.D. and a build up of dissolved oxygen to complete the stabilization in the clarifier. In computing the B.O.D. reduction actually accomplished by the filter, the B.O.D. reduction noticed in the secondary clarifier must be considered along with the reduction in the filter itself.

2. The filter unloads continually, and the sludge is light, settles rapidly and becomes septic very quickly. It seemed advantageous to return this sludge, from the secondary clarifier, to the wet well to allow it to resettle in the primary clarifier rather than to the digester where it increased the amount of supernatant noticeably.

3. Dosages as high as 35 mgad. and organic loading of 3.6 lb. of B.O.D. per cubic yard of stone had no detrimental effect on the efficiency of the filter.

4. Low pH values of 6.6 did not seem to adversely affect the operation of the digester. Total acidity is a better indication of digester activities. The value of lime is questionable.



Primary Clarifier in Background; Trickling Filter in Foreground

Construction Activity Increases

Although the postwar construction program of water and sewage facilities has not yet gone into high gear, data from the May 1947 issue of *Public Construction and Construction Materials* published by the Federal Works Administration indicates that new construction activity in 1947 is definitely up over that in 1946. Excluding maintenance and repair, the estimated new construction activity is shown in the following table:

EST. NEW CONSTRUCTION ACTIVITY IN U. S.

Period Covered	Millions of Dollars Water	Sewage
April, 1946	6	4
March, 1947	9	11
April, 1947	12	14
May, 1947	13	15
1st Quarter, 1946	14	11
1st Quarter, 1947	24	30

WATER AND SEWAGE PATENTS

(Of Recent Issue)

WATER PATENTS

Clarification of Aqueous Liquids. John W. Ryznar (to National Aluminate Corp., Chicago, Ill.); U. S. 2,420,340; May 13, 1947 (Appl. 10-26-44). A process of clarifying aqueous liquids containing suspended solids by the addition of a small amount of saponite.

Pump. Alexander V. Mueller (to The Deming Co., Salem, Ohio); U. S. 2,420,556; May 13, 1947 (Appl. 11-24-43).

Apparatus for Effecting Clarification of Turbid Liquids. Ralph B. Carter, Jr. (to Ralph B. Carter Co., Hackensack, N. J.); U. S. 2,422,656; June 24, 1947 (Appl. 7-14-44). A rectangular flocculating apparatus with transverse baffles (over and under type) so constructed that the baffles can be raised and lowered on a shaft, with one set of alternate baffles being raised while another set is lowered. Thus the positions of the alterate baffles may be changed to opposite positions in the tank. This action which takes place intermittently allows the accumulated floc behind the lowered baffle to be moved along by the flow of liquid.

Liquid Flow Calculator. James W. Feild, Alexandria, Va.; U. S. 2,422,663; June 24, 1947 (Appl. 3-1-46). A circular slide rule comprised of stationary discs, rotating discs, and radial rotating arms, whereby quantity of flow in a circular pipe can easily be calculated if the depth of the liquid in the pipe, the velocity of flow or slope of the pipe are known.

Gaging and Sampling Apparatus for Liquid Storage Tanks. John H. Wiggins, Chicago, Ill.; U. S. 2,422,869; June 24, 1947 (Appl. 2-5-45). An integral part of a liquid storage tank, a means of both sampling the contents and gaging the liquid level therein.

Backwashing Means for Filtering Apparatus by Reverse Flow of Filtrate. George Martin Booth (to Wallace & Tiernan Co., Inc., Belleville, N. J.); U. S. 2,423,172; July 1, 1947 (Appl. 4-19-44). An upflow pressure filter with means for compressing air above the filtered water on the top side of the filtering medium, said compressed air being utilized to force filtered water back downward through the filtering medium, thereby back washing the medium. Waste is drawn off at the bottom during this operation.

These patent abstracts being brief do not necessarily cover the entire scope of the invention described. If the reader becomes especially interested in any of these patents he should obtain printed copies of the complete patent, at 25 cents each, from the Commissioner of Patents, Washington 25, D. C.

Apparatus for Feeding Solution to Water Comprising Receptacles Having Vertically Adjustable Chambers Connected Therewith. Robert H. Geiser, Waynesboro, Pa.; U. S. 2,423,379; July 1, 1947 (Appl. 8-14-42). An apparatus for feeding solutions from a constant level chamber to a pressure chamber, with means for adjusting height of constant level chamber to maintain necessary pressure to discharge into pressure chamber.

Quick Breaking Union for Pipe Ends. Joe Prata, Torrance, Calif.; U. S. 2,423,726; July 8, 1947 (Appl. 6-7-45).

SEWAGE PATENTS

Garbage Disposal Device. Frank T. Hilliker, St. Louis, Mo.; U. S. 2,421,064; May 27, 1947 (Appl. 10-9-44). A garbage grinder powered by a motor located below the grinder which operates at the bottom of a tank in which garbage is kept submerged in water.

Mechanical Aerating Device. Augustus C. Durdin III (24 per cent to Lewis H. Durdin, Franklin, Pa., and 52 per cent to August C. Durdin, Jr.; the Northern Trust Co. executor of said August C. Durdin, Jr., deceased); U. S. 2,421,191; May 27, 1947 (Appl. 2-2-44). Mechanical aerator comprising a tube for fluid flow flared at outlet (lower) end, and an impeller at the upper (cone) end of the tube to cause circulation of liquid from surface of tank to bottom while causing the entrainment of air.

Treatment of Sulphite Pulp and Liquor. Johan Astrom (to Svenska Cellolosa Aktiebolaget, Stockholm, Sweden); U. S. 2,421,590; June 3, 1947 (Appl. 11-24-43). Method of washing sulphite waste liquor from sulphite pulp by washing with distillery slop from distillation of alcohol from fermentation process using waste sulphite liquor.

Plug Valve. Leland S. Hamer, Long Beach, Calif.; U. S. 2,421,879; June 10, 1947 (Appl. 7-19-44).

Plug Valve. Franklin E. Shelly (to Tube Turns, Louisville, Ky.); U. S. 2,421,969; June 10, 1947 (Appl. 4-23-43).

Water Conditioning Machine for and Oil Well Operated by Water Flowing from Said Well for Feeding Reagent to Water. A chemical feeding machine for treating water discharged from an oil well with the dosage regulated to the flow of water by a means actuated by the flow of water itself.

16th Georgia Water and Sewage School

Scheduled for Sept. 17-19

Three days of instruction in water and sewage treatment will be offered at the 16th Annual Water and Sewage School to be held at the Georgia School of Technology, on Sept. 17 to 19 incl. The material to be presented at the school is adapted to all types of water supply and sewage works.

Topics to be presented will include public relations, financing water and sewage works, chemistry of water and sewage treatment, operation of pumps, maintenance of elevated tanks, chlorination of water and sewage, etc.

Inquiries concerning the school should be directed to W. H. Weir, Public Health Engineer, State Dept. of Health, Atlanta, Ga.

Great Weather Extremes in the Offing

By HALBERT P. GILLETTE*
SAN MARINO, CALIF.

IN *WATER AND SEWAGE WORKS*, June, 1946, I said: "The 67-year cycle will have its next cold-wet peak in 1950. Its effect has been seen in recent years, notably in the very wet year of 1945." Since writing that article, I have found that the 67-year cycle is a harmonic submultiple of a very powerful cycle of 268 years whose next cold-wet peak will also occur in 1950, greatly intensifying the abnormality of the weather then and for several years before and after that date.

In England, last winter was one of the severest in respect to precipitation and cold in the memory of the oldest inhabitant and the ground water table has risen to the highest level in years. In the United States we are experiencing an unusually cold-wet spring, with attendant floods of magnitude and frequency. The preceding cold-wet peak of 268-year cycle should have occurred in 1682. Actually the two coldest winters to occur in sequence in England were those of 1684 and 1685, when the Thames froze so solid that horses drew heavily loaded sleds across it. Only once before, in 1565, is this known to have occurred. But in 1408 the Baltic sea was frozen solid, and that was only six years prior to another peak of the 268-year cycle.

H. H. Turner in 1919 was the first to publish evidence of a climatic cycle of this order of length. He called it 260 to 280 years between similar extremes, and eventually concluded that it was a cycle of about 260 years. So did another investigator, Mohorovicic, who saw evidence of it in the annual lowest levels of the Nile between 622 and 1470 A. D. Long gaps in subsequent records prevent further confirmation by Nile data of the "260-year" cycle's existence.

Since there is a tendency for many of the long weather cycles to be harmonic, it occurred to me that Turner's cycle might be 4x67 or 268 years between similar extremes. I was soon able to show this to be a fact, and to date its peaks accurately. Accuracy of dating was aided by finding harmonic subcycles of 1/3, 1/9, 1/27, 1/81 and 1/243 of

"H. P."

268 years. All these subcycles will have their next peak in 1950.53 or July 12, 1950.

The cycle of 1/27 of 268 or 9.93 years has long been known, but regarded as having a length of as little as 9.6 to as much as 10 years. Its amplitude, or departure from a mean, is much greater in weather than is that of the 11 1/6-year cycle which is correlated with the celebrated sunspot cycle discovered by Schwabe, a German apothecary, who announced it in 1843.

"Dust-Bowl" Conditions Now Explainable

It is now possible to explain the series of great droughts that caused "dust-bowl" conditions, the worst of which was in 1934. The warm-dry maximum of the 268/9 or about 29.8-year cycle was due about 1950.5-14.9 or 1935.6 A. D. But some other cycle evidently combined with it to bring the worst condition a year earlier.

In 1912 Simon Newcomb showed that the longitude of the moon differs slightly from that calculated by gravitative theory, causing a 270-year cycle in its major departures. He suggested variations in the load of polar ice, for that would cause variations in the oblateness of our globe and consequently in its rotation. But he said it was "the most perplexing enigma in astronomy." The solar electron theory now offers a solution of the problem, for increased bombardment of the earth by the electrons must induce stronger magnetic forces that shorten the magnetic axis. If so, there was lengthening of that axis with its maximum about 1816 A. D., which was not far from the time the day was shortest; and about 1950 it will be longest as a result of the effect of the 268-year cycle peak.

Turner and Frothingham independently, in 1919, found a cycle of about 260 years in the frequency of Chinese earthquakes back to 200 A. D. I ascribe this to the 268-year cycle of bombardment of the earth by solar electrons, for several of the earthquake peaks were near cold-wet peaks of the 268-year cycle. Peaks of auroral frequence since 400 A. D. also have often been near these cold-wet peaks. Induction of magnetism in the earth by the solar electrons that cause auroras must cause increased magnetic forces that tend to distort the earth, particularly in certain regions.

The general magnetic field of the earth, as well as those of numerous foci, are attributable, I believe, to magnetism induced in ferriferous matter by streams of solar electrons.

According to H. I. Jensen, "There is very definite evidence that our inland country in eastern Australia has deteriorated enormously in rainfall during the past 50 years." Therefore, I infer that the phase of the 268-year weather cycle in Australia is opposite to that in England, for example, and that droughts in Australia will grow worse until 1950. Thereafter they probably will ameliorate very slowly, as is the case where a very long cycle is acting; but will be relieved at intervals by the subcycles of the 268-year cycle, one of which, not mentioned above, is a cycle of 1/12 its length or 22 1/3 years—a very important weather cycle of just double the length of the Schwabe sunspot cycle.

Numbers of Sunspots no Criterion Alone

Numbers of sunspots alone are no criterion of storminess. The hemisphere whence electrons spiral forth from whirling, cyclonic sunspots, or the like, is, I believe, a controlling factor. For the spiral motion of the emitted electrons gives to them magnetic polarity. Those issuing from the sun's southern hemisphere are attracted magnetically toward magnetic foci in our northern hemisphere, but repelled by magnetic foci in our southern hemisphere. That explains

*President, Gillette Publishing Co.

the droughts in Australia in recent years, for sunspots, on the average, have been more numerous in the southern hemisphere. This disparity increases as a peak of the 268-year cycle approaches, as was shown near its last peak in 1682, for no spots at all were seen between 1672 and 1704! That extreme condition, however, was not due solely to the 268-year cycle, for cycles of 3 times and 9 times its length also had their peaks in 1682.

The 2412-year cycle had its warm-dry maximum 1206 years prior to 1682 or 476 A.D. It was about then that the Western Roman Empire fell under the assaults of its foes, and the "Dark Ages" began.

Behavior of the Compass Significant

I have found excellent evidence of the 268-year cycle in the behavior both of the compass and the dipneedle. On our middle Atlantic Coast, the swing of the compass toward the west was a maximum about 1682, whereas its eastward swing was a maximum about 1816. This shows the magnetic north pole to have been strongest about the cold-wet maximum. It is now approaching another, though lesser maximum of western declination which will occur about 1950.

While the north end of the compass on our Atlantic coast has long been moving westward, that in London has been moving eastward, indicating control by the Siberian magnetic focus. In Australia the movement of the south-seeking end of the compass has been westward, which means long continued weakening of the south magnetic pole which controls the compass in Australia. This indicates that, whereas increasing numbers of solar electrons have been bombarding the magnetic foci of the northern hemisphere, fewer have been bombarding the southern hemisphere; hence the prolonged succession of droughts in Australia, for solar electrons not only act as nuclei of condensation of atmospheric moisture, but, moving in the magnetic field of the earth, cause whirling cyclones and anticyclones, both stationary and migrating, upon which, I believe, the circulation of the atmosphere mainly depends.

Although equal numbers of negative electrons and positive protons bombard the earth, the electrons have much greater whirling velocity because the mass of an electron is about 1/1850 that of a proton. Because of this dominant effect of the electrons in causing whirls in the atmospheres of both sun and earth, we may speak of these whirls as being electronically caused in a magnetic field.

The reader who may be interested in knowing how whirls are thus produced in liquids will find brief accounts of the experiments of Davy and Ritchie in Encyclopedia Britannica, under Electricity, and longer accounts in Faraday's Experimental Researches in Electricity, Vol. I, p. 528 and Vol. II, pp. 127-163. In view of the importance of magnetic rotation of electric current (discovered by Faraday in 1821), it is surprising how little (sometimes nothing) is said about it in many college text-books on Physics. Indifference to this Faraday principle on the part of authors of such text-books may account largely for the tendency of meteorologists to ignore the electron theory of cyclones and anticyclones that has been repeatedly published in this journal since 1929.

Often a Gap Between, Theory or Observation and Quantitative Proof

If it should be contended that quantitative sufficiency of electronic forces must be shown before this theory can be regarded as established, a reply is not far to seek—namely, that established scientific theories of causation that can show quantitative sufficiency are rare. For instance, it was about 300 B.C. that a Greek navigator, Pytheas, discovered that the moon causes tides. His discovery resulted from observing correlations between certain phases of the moon and high tides. Yet twenty centuries were to elapse before Isaac Newton was to prove the quantitative sufficiency of the moon's gravitative force to produce tides.

Because of changes both of location and intensity of the semi-permanent cyclones and anticyclones, and the opposite nature of their effects on weather in different regions, the peak of a given cycle of influx of solar electrons may cause droughts in one place and floods in another. Sometimes the regions of opposite effect are not far apart. San Francisco, for example, may be abnormally dry during a period when Portland, Oregon, is abnormally wet. Since storm-tracks across America tend to shift northward near peaks of influx of solar electrons, we may expect such differences more frequently than usual during the next decade or longer.

Water Co. in Streator Installs Diesel Standby Power

The Northern Illinois Water Corp., which is located in and serves some 20,000 persons in Streator, Ill., and surrounding unincorporated areas, recently completed the major task of reconverting and modernizing its main pumping station. Formerly powered by steam turbine, the new main pump will be operated by electricity. As standby power for emergency use a General Motors 200 Twin 6 Diesel engine was installed, with direct connection to a dual valve centrifugal reserve pump having a capacity of 4,000,000 gallons per day. This capacity is approximately equivalent to the present peak load of the station and H. B. Janzen, manager of the plant, expects that the two systems will operate simultaneously during overload periods and times of emergency.

Tenth Louisiana Short Course

The Tenth Annual Short Course for water and sewage works men in Louisiana was held on June 18, 19 and 20 in the Geology Building at the Louisiana State University. The Short Course is sponsored by the General Extension Division of the College of Engineering of Louisiana State University in cooperation with the Louisiana State Dept. of Health and the Louisiana Conference on Water Supply and Sewerage.

The three day meeting ended with examinations for certificates.

The Short School is under the direction of John H. O'Neill, Dept. of Public Health.

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MEETINGS SCHEDULED

Aug. 23—BOUND BROOK, N. J. (Calco Recreation Park)
New Jersey Sewage Works Ass'n. (8th Annual Outing) (Noon until 6 P. M.) Chairman, Lou Fontenelli, Box 283, Manville, N. J.

Aug. 25-27—STATE COLLEGE, PA. (Nittany Lion Inn)
Pennsylvania Sewage Works Assn. Sec'y-Treas., Bernard S. Bush, Kirby Health Center, Wilkes-Barre, Pa.

Aug. 27-29—STATE COLLEGE, PA. (Nittany Lion Inn)
Pennsylvania Water Works Operators' Assn. Sec'y, I. M. Glace, 1001 Front Street, Harrisburg, Pa.

Sept. 4-5—PLATTSBURG, N. Y. (Hotel Champlain)
New York Section, A.W.W.A. Secretary, R. K. Blanchard, 50 West 50th St., New York, N. Y.

Sept. 16-19—BOSTON, MASS. (Statler Hotel)
New England Water Works Assn. Sec'y, Jos. C. Knox, 609 Statler Bldg., Boston, Mass.

Sept. 17-19—ATLANTA, GA. (Ga. School of Technology)
Annual Water & Sewage School. Sec'y, Van P. Enloe, Rt. 5, Box 363, Atlanta, Ga.

Sept. 18-20—BAY CITY, MICH. (Wenonah Hotel)
Michigan Section A.W.W.A. Sec'y, R. J. Faust, State Dept. of Health, Lansing, Mich.

Sept. 22-24—LOUISVILLE, KY. (Brown Hotel)
Kentucky-Tennessee Section A.W.W.A. Sec'y, R. P. Farrell, 420 6th Ave., N., Nashville 3, Tenn.

Sept. 25-26—DENVER, COLO. (Cosmopolitan Hotel)
Rocky Mountain Section A.W.W.A. Secretary, O. J. Ripple, 710 Colorado Bldg., Denver, Colo.

Sept. 25-26—GRAND FORKS, N. D. (Dacotah Hotel)
North Dakota Water & Sewage Works Conference. Nineteenth Annual). Sec'y, R. M. Jensen, Supt., Grand Forks, N. D.

Sept. 30-Oct. 1—COLUMBUS, OHIO (Deshler-Wallick Hotel)
Ohio Section A.W.W.A. Sec'y-Treas., F. P. Fischer, 812 Perry Payne Bldg., Cleveland, Ohio.

Oct. 2-3—COLUMBUS, OHIO (Deshler-Wallick Hotel)
Ohio Conference on Sewage Treatment. Sec'y-Treas., L. B. Barnes, 441 S. Prospect St., Bowling Green, Ohio.

Oct. 2-3—BLUEFIELD, W. VA. (Hotel West Virginian)
West Virginia Section A.W.W.A. Sec'y, J. B. Harrington. State Department of Health, Charleston, W. Va.

Oct. 5-8—JACKSONVILLE, FLA. (Hotel not selected)
American Public Works Association. (Annual Meeting) Exec.-Dir., D. F. Herrick, 1313 E. 60th Street, Chicago, Ill.

Oct. 6-8—NIAGARA FALLS, ONTARIO (General Brock Hotel)
Canadian Institute on Sewage & Sanitation. Sec'y-Treas., A. E. Berry, Ontario Department of Health, Toronto 8, Ont.

Oct. 6-10—ATLANTIC CITY, N. J. (Convention Hall)
American Public Health Association. (75th Annual Meeting.) Exec.-Sec'y., Reginald M. Atwater, M. D., 1790 Broadway, New York, N. Y.

Oct. 8—DOVER-FOXCROFT, ME.
Maine Water Utilities Assn. Sec'y, Earle A. Tarr, Winthrop, Me.

Oct. 8-10—ATLANTIC CITY, N. J. (Haddon Hall)
Pennsylvania Water Works Association. Sec'y-Treas., E. R. Hannum, 510 Telegraph Bldg., Harrisburg, Pa.

MEETINGS SCHEDULED

Oct. 9-11—CEDAR RAPIDS, IOWA (Hotel Montrose)
Iowa Section A.W.W.A. Sec'y-Treas., H. V. Pedersen, Municipal Bldg., Marshalltown, Iowa.
(Joint meeting with)
Iowa Sewage Works Assn. Sec'y-Treas., Robert D. Mott, Iowa City, Iowa.

Oct. 13-15—AMARILLO, TEXAS (Hotel Herring)
Southwest Section A.W.W.A. Sec'y-Treas., L. A. Jackson, Robinson Memorial Auditorium, Little Rock, Ark.

Oct. 16-17—OCEAN VIEW, VA. (Hotel Nansemond)
Virginia Industrial Wastes & Sewage Works Assn. (First Annual Conference). Sec'y-Treas., A. H. Paessler, 815 E. Franklin St., Richmond 19, Va.

Oct. 23-25—MILWAUKEE, WISC. (Hotel Schroeder)
Wisconsin Section A.W.W.A. Secretary, L. A. Smith, Supt. Water Works, Madison, Wisc.

Oct. 27-28—JEFFERSON CITY, MO. (Governor Hotel)
Missouri Water & Sewerage Conference. Sec'y-Treas., W. A. Kramer, State Board of Health, State Office Bldg., Jefferson City, Mo.

Nov. 3-5—ATLANTA, GA. (Biltmore Hotel)
Southeastern Section A.W.W.A. Sec'y, W. T. Linton, State Board of Health, Wade Hampton Office Bldg., Columbus, S. C.

Nov. 6-8—ATLANTIC CITY, N. J. (Hotel Claridge)
New Jersey Section A.W.W.A. Sec'y-Treas., C. B. Tygert, Box 178, Newark, N. J.
(Joint meeting with)
South Jersey Assn. Water Supts. Sec'y, Walter Spencer, 2707 Bethel Ave., Merchantville, N. J.

Nov. 10-12—GREENSBORO, N. C. (Sedgfield Inn)
North Carolina Section A.W.W.A.
North Carolina Sewage Works Association. Sec'y-Treas., Geo. S. Moore, P.O. Box 125, Albemarle, N. C.

Nov. 12-14—PITTSBURGH, PA. (Hotel Wm. Penn)
Engineers' Society of Western Penna. (8th Annual Conference) Gen. Chairman, H. M. Olson, Wm. Penn Hotel, Pittsburgh, Pa.

Nov. 17-18—ROANOKE, VA.—(Hotel Roanoke)
Virginia Section A.W.W.A. Sec'y-Treas., W. H. Shewbridge, 708 State Office Bldg., Richmond, Va.

Nov. 19-21—WASHINGTON, D. C.—(Wardman Park Hotel)
Four States Section A.W.W.A. Sec'y-Treas., W. A. Welch, 748 Public Ledger Bldg., Philadelphia, Pa.

Nov. 20—BOSTON, MASS. (Statler Hotel)
New England Water Works Assn. Sec'y, Jos. C. Knox, 609 Statler Bldg., Boston, Mass.

Nov. 20-22—ST. PETERSBURG, FLA. (Suwannee Hotel)
Florida & Cuban Sections A.W.W.A. (Joint Meeting) Sec'y Fla. Section, A. P. Black, University of Florida, Gainesville, Fla., Sec'y Cuban Section, Laurence H. Daniel, Box 531, Havana, Cuba.

Dec. 10—WINTHROP, ME.
Maine Water Utilities. Sec'y, Earle A. Tarr, Winthrop, Me.

Dec. 18—BOSTON, MASS. (Statler Hotel)
New England Water Works Assn. Sec'y, Jos. C. Knox, 609 Statler Bldg., Boston, Mass.

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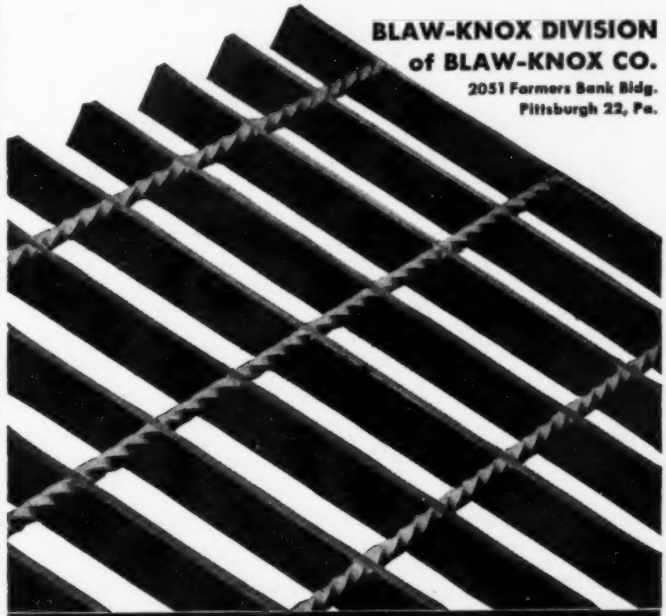

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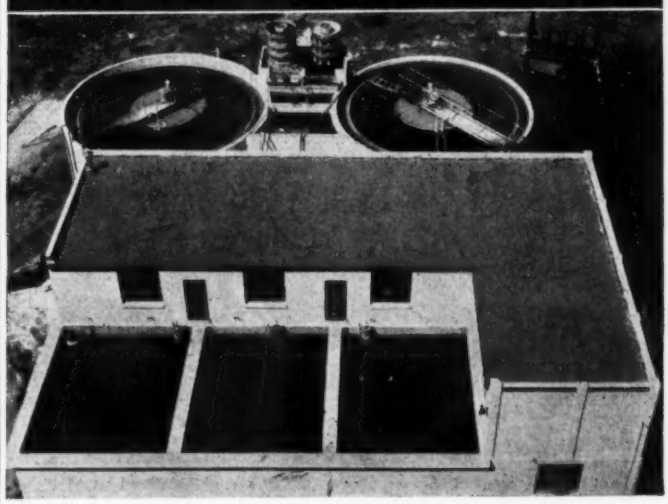

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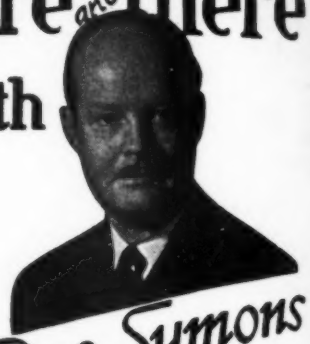


H. T. M. A.—And this month he's without a single special announcement.—Not that I haven't a couple of ideas to throw at you, but August hardly seems to be the month for new ideas.—And yet this column was started in August (four years ago)—and people are still reading it—I hope, I hope, I hope!

* * *

I wouldn't have been surprised if Samuel F. Newkirk's middle initial were P. instead of F., with the P. standing for "Puzzle." Now he has solved an impossible puzzle in which a squirrel in a cage can run fast enough from one end to the other to stick his head out of both ends at the same time. Can be done, he says.—A year's subscription to this column to the first one that tells me how Sam can do it.

* * *

With the Penna. Water Works Operators' Assn. meeting again this month, I'm reminded that on last year's program Marsden Smith, the bridge expert from Richmond, Va., told how he had been invited to appear on that program to talk on "Filter Rates." Secy. Mike Glace had forgotten that five years previously Marsden had presented a paper on that very topic at Mike's request.—How can you forget anything Marsden has said, Mike?—Or do you invite your speakers back every five years to give the same talk? If so, does that mean that in 1952 I'll be giving my talk on Public Relations again?

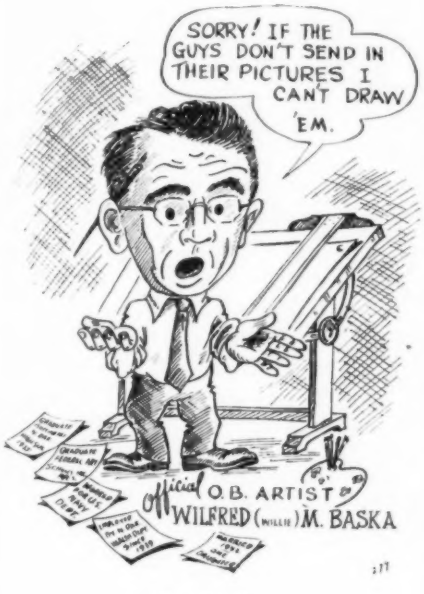
* * *

California, Here I Come. As I write this particular column, I'm just about ready to leave for the big twin conventions in San Francisco. This is my first trip west (west of St. Louis and Texas, that is) and I'm really looking forward to it. When I come back I should have a whole flock of new stories for the column

and a great many new friends. In addition, I hope I see a lot of my old friends there, too. I'm looking forward to a pleasant trip out on the same car with the Jack Van Atta's, the Casey Jones', the Dan Saunders', the Wendell La Due's, Attmore E. Griffin and Harry Boehner.

* * *

I always get a kick out of the pen and ink sketches which appear regularly in the Official Bulletin of the North Dakota Water and Sewage Conference, and I thought you might like to see the "guy what draws 'em." And please note that I am not the only fellow who is always begging for material.



* * *

Paid Advertisement. Program Chairmen, Attention! Are you worried about the dinner speaker for your next convention? Hire "Doc" Symons, editor, author, lecturer, traveler, columnist, and one time water and sewage works operator. —Speaks for price of dinner. Has variety of topics. Try:—How Are Your Relatives, Public—That Is; Oh, Rats; Meet Mr. Insect; What's in a Nickname?; The Audience Talks Back; Wonderful Things—Words; Water Isn't H_2O; Biblical Waters; Why Waste It?; There's Always Been Water and Sewage; *or* if you really want something for your money, ask for the Giant Jumbo Potpourri titled "Here and There With Doc Symons." For particulars write Box H & T, care of this magazine. (Note: This is a paid advertisement and this column takes no responsibility therefor.)

* * *

HOW R-C *dual-ability* SOLVES BLOWER PROBLEMS FOR SEWAGE PLANTS

You'll be interested in the many applications of Roots-Connersville Blowers, illustrated in this new bulletin. It contains factual evidence of our *dual-ability* to design either Centrifugal or Rotary Positive units and shows how they match the needs of present-day sewage disposal plants, either large or small.

It indicates also how these units can be adapted to any modern drive — how they save first cost and operating cost. If you're planning new or enlarged facilities or replacements, you'll be helped by this new booklet. Ask for Bulletin No. 23-120-B10. It's free, of course.

ROOTS-CONNERSVILLE BLOWER CORP.

708 Mount Avenue, Connersville, Indiana

ROOTS-CONNERSVILLE ROTARY CENTRIFUGAL

BLOWER BUILDERS R-C SINCE 1854

BLOWERS · EXHAUSTERS · BOOSTERS · LIQUID AND VACUUM PUMPS · METERS · INERT GAS GENERATORS

ONE OF THE DRESSER INDUSTRIES

There are a great many of my friends with whom I used to carry on a regular correspondence (in addition to this column, which is a monthly letter to every one), and I'm sure that most of those friends are wondering what ever happened to the letters I used to write. The explanation is simple. I own a house. And what does owning a house have to do with letter writing?—Well, I can't write letters and paint screens, paint windows, paint the porches, take care of the lawn, keep the flower beds weeded, clean the garage, build a picket fence, etc., etc., etc., all at the same time. So you folks in Oxford, Eng., Toronto, Buffalo, Toledo, Indiana, Illinois, Texas and points south and west will have to fo'give me. Maybe in another six months, hmm!

* * *

I can't claim too much success in my campaign for the metric system and the World Calendar, but here's a cause in which I'll bet I can enlist all of the men in—I'd like to see our American clothes designers make some men's clothes that would be comfortable, particularly in the summer. Doesn't it seem silly to you to realize that here in America, where we can develop the atomic bomb and do all of the wonderful scientific things we do, that we still can't make a man's suit that is comfortable?

On the face of it, isn't it downright stupid that we have to wear, not one thickness of cloth about the neck, but at least seven, four in a collar and three in a necktie. Women are smarter; they open up the neck so the body can breath and keep itself cool. Then we men wear a shirt with sleeves, and a coat with collar of several thicknesses, even in summer and have the thing fit so tightly that it is impossible for the body to evaporate off the water necessary to maintain itself cool.

Add to that, we put on a pair of pants that would be fine for causing a draft up the pants legs to cool the body and then we put on a belt and draw it tight so that no draft of air can pass upward over the body. Even the cloth of which our clothes are made is not designed to permit free passage of air. Silly beasts, aren't we? Yes, sir, the women are more sensible—except, of course, for that instrument of torture known as the two-way stretch.

Fashion certainly has made fools of us all. I know that a better and more comfortable suit of clothes could be designed for men if the fashion dictators would just let us wear them, and I don't mean bathing suits either. But when a local restaurant in our village wouldn't let me eat there because I wore no coat (I had on a tie) and when another made no objection to coming in coatless but did object to wearing suspenders (braces to my Oxford friend) without a coat, then maybe we need more than just some better and more scientifically designed clothes. Maybe we need some sensible rules of fashion.—How about it, boys, are you with me on this campaign?

* * *

Speaking of this column—as I always am—Harry (Chlorine Institute) Faber buttonholed me one day recently to say, "There are a couple of minor mysteries that have been appearing regularly in your column, and Sara and I want to know what they're about."

"Okay," says I, "what do you want to know?"

"Well," says Harry, "what do the initials H. T. M. A. stand for at the beginning of each column,—and who is Buffalo Bodie?"

"Well," says I, in return, "H. T. M. A. are the initials of the first

PEERLESS PUMPS
add a "plus"
TO DEEP WELL PUMP PERFORMANCE

Peerless Pumps offer the widest range of water capacities from 15 to 30,000 gallons per minute from all depths

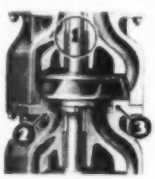
*

Peerless Pioneered in the development of water from wells of great depth.

Available in water or oil lubricated types. Pre-tested to meet exact conditions of well and application.

Top-Flight Quality Underground From Patented Double Bearing—Double Seal Bowl Construction

Double Bearings (1) one bronze and one Goodrich Cutless Fluted Rubber bearing for each pump bowl add double life to bearings and impeller shaft. Double Seal (2) mounted below impeller neck (3), is a durable, resilient ring — automatically compensating for wear.



Choice of Pump Drives

Contributing to the over-all operating adaptability of Peerless Deep Well Turbine Pumps are the optional type Peerless drives. Moturbo (electric) heads are available from 1 to 1,000 h.p. Gearturbo (geared) heads range from 1 to 300 h.p. All types are highly advanced in design and are proved through years of operation under every pumping condition. Also furnished are Veeturbo, (V-belt) and Belturbo, (flat belt) and combinations of these drives.

Peerless Turbine design permits wide adaptability to diversified applications

Peerless turbine pumps are the choice of industry and municipalities for an ever dependable source of clean, constant temperature water. Also available: Close-coupled type Peerless Turbine pumps for pumping from shallow pits, sumps, or surface water sources. With proper fittings Peerless Turbine pumps are Underwriters' approved for adequate independent plant fire protection.

Request Bulletins.

PEERLESS PUMP DIVISION
Food Machinery Corporation

Factories: Indianapolis, Indiana • Quincy, Ill. • Los Angeles 31, Calif.
District Offices: Canton 2, Ohio; Philadelphia: Suburban Square, Ardmore, Pa.
Atlanta: Rutland Bldg., Decatur, Ga.; Dallas 1, Texas; Los Angeles 31, Calif.

four words I always say (after 'Ladies and Gentlemen'), whenever I give an after dinner speech. Listen in some time.—And who is Buffalo Bodie? Why, he's the fellow who taught me to say 'Holy Little Red Roarin' Tomato Cans' when 'Holy Toledo' isn't strong enough!"

* * *

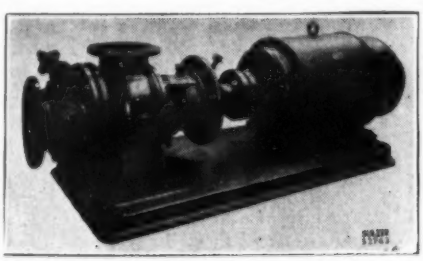
By the way, Fred (Kwik-way) Stuart, are you keeping your eye on that mustache at the head of this column?—V.T.Y., Doc.

MANUFACTURERS' and EQUIPMENT NEWS

New Dorr Equipment

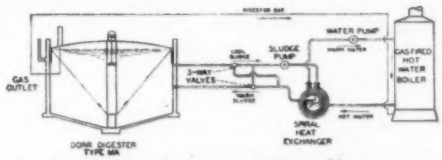
Among the six new items of sewage works equipment developed and introduced recently by the Dorr Co. are the Dorrco Sulzer Screenings Disintegrator, and an external sludge heater.

The Dorrco Sulzer Disintegrator, shown in the accompanying photograph was developed by Sulzer Bros. of Switzerland, and is being marketed in this country by the Dorr Co. Essentially a motor-driven



low-head pump with fixed and rotating cutting blades arranged in front of a perforated screening plate, this new unit is an improved heavy duty screenings grinder. All screenings passing through the disintegrator are efficiently ground to any reasonable degree of subdivision.

The external sludge heater is a spiral flow type heat exchanger manufactured by the American Heat Reclaiming Corp. and redesigned for sludge heating. The accompanying illustration shows the arrangement of the two concentric spiral passageways for the sludge and hot water. Hot water from a boiler fired by digester gas, is passed through one spiral passageway in a direction counter current



to the flow of supernatant liquor or intermediate tank contents in the other. Both water and liquor are pumped at relatively high velocities to insure high heat exchange values.

Water and sludge passageways are entirely separate and free from obstruction or short radius turns that might cause clogging.

These new items were introduced and displayed at the AWWA-FSWA Conventions in San Francisco in July. Other new equipment also displayed in San Francisco included the Dorr 7-S Clarifier, the Duo-Clarifier, the Duo-Filter, and the Type M Digester. Information on these new units may be obtained by writing the Dorr Co., 570 Lexington Ave., New York 22, N. Y.

FOR SEVERE CORROSIVE CONDITIONS...
BITUMASTIC #50 COATS THICK AND TOUGH!
ONE COAT THIS THICK
TWO COATS THIS THICK
THREE COATS THIS THICK

DO YOU WANT IT THICKER?

IF YOU DO, add another coat! There is no limit to the thickness or toughness of the Bitumastic protective sheath you can build up on metal, concrete or masonry where active acids and fumes create a need for unusual measures to combat corrosion.

In spite of its thickness, Bitumastic #50 works easily and is applied readily with a brush. The highly refined coal tar pitch that forms its base is universally accepted as the strongest seal against corrosive action.

There's a data sheet devoted exclusively to the subject of corrosion-proofing for Sewage Disposal Plants—ask for form 342 address Wailes Dove-Hermiston, Westfield, N. J.

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WESTFIELD, NEW JERSEY
New York 4 • Philadelphia 8 • Cleveland 14 • Chicago 3 • Houston 2
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G. E.'s Disposall Now Generally Available

Pioneering the field in 1935 on garbage grinding in the home for disposal to the sewers, the General Electric Co. has continued to develop the appliance. Until recently the device was available only on an allocation basis, but since the establishment of a factory in White Plains, N. Y. in 1946 it has been possible to step up production many times and Disposalls are now generally available throughout the country according to a recent announcement of the General Electric Co. The most recent models contain fewer parts, are lighter in weight, and smaller in size while having greater capacity than older models.

Carborundum to Open Chicago Warehouse

Vice Pres. and General Sales Manager, F. J. Tone, Jr., announces the purchase by The Carborundum Company, Niagara Falls, N. Y., of the former assembly plant of Philco Corporation at 3345 West 47th Street in the Central Manufacturing District at Chicago, Ill. The acquired building, after additions and alterations, will become the Chicago sales offices and warehouse of The Carborundum Company and will be under the direction of C. E. Hawke, Domestic Sales Manager, W. C. McCargo, Regional Sales Manager, with Gordon C. Watson in charge as District Sales Manager.

O. F. Gang Pres. Ludlow Valve

Oliver F. Gang has been elected president, director and general manager of the Ludlow Valve Manufacturing Co., Inc., succeeding Alfred W. Thompson, who becomes chairman of the executive committee. Mr.

Gang comes to the Ludlow Company from the William Powell Co. of Cincinnati and New York, manufacturers of valves. Prior to 1931 Mr. Gang was associated with the Lunkenheimer Co., also manufacturers of valves in Cincinnati.

Two New Mathieson Sales Representatives

The Mathieson Alkali Works has added J. A. Heinbeck and James G. Johns as Specialties Sales Representatives. Heinbeck will cover Indiana, eastern Michigan, and the Chicago area. Johns will cover northern New Jersey, and Pennsylvania, southern New York and western Connecticut. Both men will handle sanitation chemicals, bleached and special detergents.

Heinbeck, a native of Chicago and a graduate of the University of Chicago, served in the war in Naval Intelligence. Johns was born in Clayton, Ala., and attended Alabama Polytechnic Institute. During the war he served in the U. S. Navy. He joined the company in 1940 as a technical sales representative.

This new publication describing meters for sewage, industrial wastes, sludge and irrigation water should be part of your file on flow measurement. Ask for Bulletin 62.

FEATURES of
BAILEY OPEN CHANNEL METERS

1. Low Cost
2. Easy to Install
3. Easy to Maintain
4. Retain Accuracy
5. Self-Cleaning
6. Adjustable Capacities
7. Indicate, Record and Integrate
8. Totalize Multiple Flows
9. Rate of Flow and Ratio Controls
10. Simple Chemical Feed Controls

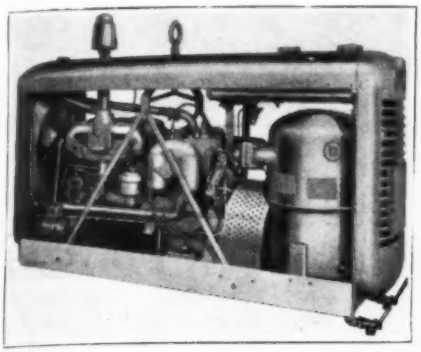
MU71

BAILEY METER COMPANY
1029 IVANHOE ROAD • CLEVELAND 10, OHIO
Meters and Controls for Sewage and Water
VENTURI TUBES, FLUMES, WEIRS, NOZZLES, ORIFICES • DIRECT MECHANICAL AND REMOTELY LOCATED REGISTERS • AIR-OPERATED, ELECTRONIC AND ELECTRIC CONTROLS.

New LeRoi Compressor for Public Utility Service

LeRoi Co., Milwaukee, has announced a new "AIRMASTER" compressor known as the "105" Utility.

Entirely self contained and light in weight (1700 lb.), it has been specifically designed for either back



of cab or on the platform of utility trucks. Floor area required is only 82 x 25 in.

The engine used is the LeRoi D226 and the liquid cooled compressor is built integrally into the engine block, with regulation by the LeRoi patented Econotrol governing compressor capacity automatically according to the demand for air.

Descriptive literature and general specifications are available and will be for arded upon request to LeRoi Co., Milwaukee, Wisc.

Payne Dean's "Porto-Power" Unit

Payne Dean & Co. of Madison, Conn. has developed a portable power unit for operating gate

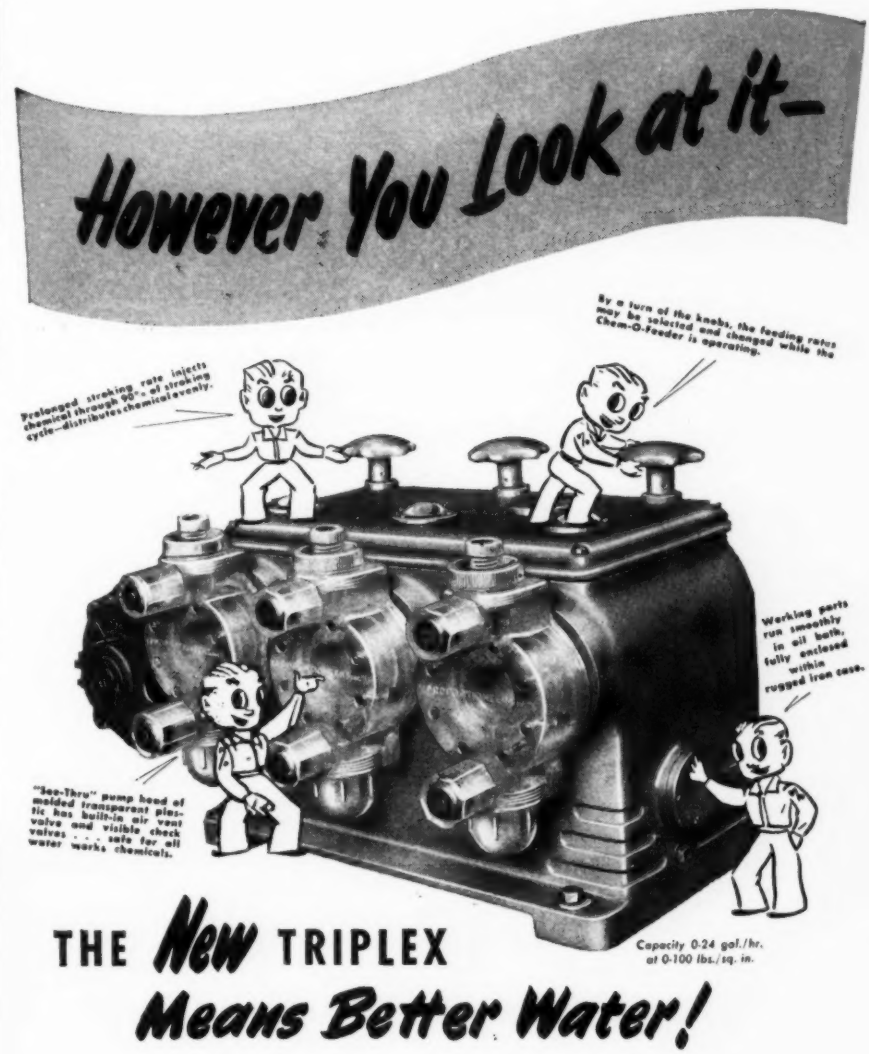
valves, filter stand valves, tapping machines, etc. This portable unit which mounts a half horsepower single gasoline engine can be easily hauled in a truck or is completely portable around a water or sewage plant.

When a steering wheel is attached, the device shown in the picture can be driven under its own power in which case it can be used as a power unit for pulling a gang lawn mower, etc. It can also be hooked up to a main tapping-machine and can be used to operate gate valves, either vertically or horizontally, and it may well find other uses where portable power is required. The usual revolution counter for checking gate valve opening and closing is a standard piece of equipment on the unit.

This unit has been named the Porto-Power by the company and further information may be obtained by writing Payne Dean & Co., Madison, Conn.

Hardinge Moves San Francisco Office

Hardinge Co., Inc., of York, Pa., has announced a change of address in its San Francisco district office. Its new quarters are at 24 California St., San Francisco, 11. The office handles business in 11 western states under the management of G. A. Wallerstedt.


However You Look at it—
By a turn of the knobs, the feeding rates may be selected and changed while the Chem-O-Feeder is operating.
Prolonged stroking rate injects chemical through 90% of stroking cycle—distributes chemical evenly.
Working parts run smoothly in oil bath, fully enclosed within rugged iron case.
"See-Thru" pump head of molded transparent plastic has built-in air vent valve and visible check valves . . . safe for all water works chemicals.
Capacity 0-24 gal./hr. at 0-100 lbs./sq. in.

THE *New* TRIPLEX

Means Better Water!

%Proportioneers% Triplex Chem-O-Feeder is compact (24" x 16" x 12" overall) and new in design . . . it feeds three different chemicals, each at a predetermined, adjustable rate. This single unit injects exactly the right amount of hypochlorite, alum, and soda ash, or any other water treating chemicals, for sterilization, coagulation, pH control, etc. Simple to operate, accurate and long-lived, the Triplex provides . . . in one package . . . *complete* economical water treatment for the new or modernized plant.

Write for complete information.

% PROPORTIONEERS, INC. %

9N CODDING ST., PROVIDENCE 1, R. I.

Higgins Vice Pres. of Rockwell International

Col. A. E. (Cappy) Higgins has been named Vice-President of Rockwell International Corp. according to an announcement of A. J. Kerr, Vice-President of the Rockwell Manufacturing Co., the parent concern.

Col. Higgins was associated with the Rockwell Co. from 1937 to 1942 when he re-entered the U. S. Army. He had previously served in the Army from 1915 to 1927 and before joining Rockwell in 1937 was Secretary of the Natural Gas Dept. of the American Gas Association. His last tour of duty with the Army ended in 1946, when he resigned as Commander of Hickam Field in Hawaii. Col. Higgins' offices are in the Empire State Bldg. in New York City.

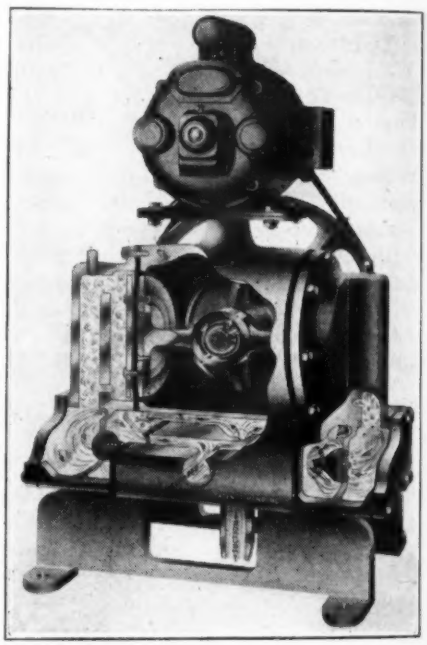
Corrosion Resistant Diaphragm Valves

The diaphragm type valve known as the Hill-McCanna Saunders Patent Valve is now obtainable from the Duriron Co., Inc. in the corrosion resistant alloys, Duriron and Durichlor. The latter alloy could be used in control of ferric chloride solutions. The valve has three basic units of construction, the bonnet, the diaphragm and the body. The diaphragm separates the liquid from the bonnet, and the diaphragm may be obtained in a variety of natural and synthetic rubber materials.

Further information on this new valve may be obtained by writing the Duriron Co., Inc., Dayton 1, Ohio.

New Type Pump for Small Water Systems

A complete departure from usual pump design is made in the new Ace "450" Water System. Based on the pumping principle of the human heart, this new all aluminum pump completely eliminates the need for impellers, pistons, cup leathers, and crank assembly.



Two pulsating diaphragms, made of material perfected through four years of wartime research provide 450 gallons of water per hour. Due to simplicity of design, no water touches the moving parts; thus sand or abrasives in the water supply cannot damage the pump. It can even run while dry without harm.

Among the many additional features are entirely rust-proof construction, sealed life-time lubrication, positive water displacement with 26 foot practical suction lift, full floating frictionless drive, and practically silent operation.

The pump will find use on individual home water supplies, outlying

IF IT'S *CLOGGED*
WE CAN CLEAN IT

In the course of cleaning close to forty million feet of pipe over a period of more than forty years, the National Water Main Cleaning Co. had developed highly specialized methods and equipment for removing practically any type of pipe accumulation or obstruction quickly, economically and thoroughly.

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KANSAS CITY.....421 B.M.A. Building
LOS ANGELES.....448 South Hill Street
MEMPHIS.....822 Dermon Building
OMAHA.....3812 Castellar Street
RICHMOND.....210 East Franklin Street
ST. LOUIS.....7103 Dale Avenue
SALT LAKE CITY....149-151 W. Second South Street
SAN FRANCISCO.....681 Market Street
MONTREAL.....2028 Union Avenue
WACO.....P. O. Box 887
WINNIPEG.....576 Wall Street
HAVANA - MAYAGUEZ, PUERTO RICO - BOGOTA - CARACAS - MEXICO CITY

sewage works, circulation systems, etc.

Further information may be obtained from Ace Pump Corp., 138 Hernardo St., Memphis, Tenn.

Harold Hoefman Vice-Pres. Link-Belt

According to an announcement of the Link-Belt Co., Harold L. Hoefman has been elected vice-president in charge of manufacturing. Mr. Hoefman, who has been general manager of the company's Pershing Road plant, Chicago, since

H. L. Hoefman

D. E. Davidson

1943, entered the employ of this plant in 1920 as a draftsman. He subsequently held various important positions as sales engineer at Chicago, Kansas City and Dallas.

Announcement was also made that David E. Davidson has been appointed general manager of the Pershing Road plant, to succeed Mr. Hoefman.

Mr. Davidson, who has headed the engineering department at the Pershing Road plant since the beginning of the year, is a mechanical engineering graduate of Armour Institute of Technology (I. I. T.) and entered the employ of the company's Caldwell plant, Chicago, in 1924 in the shop.

Smith Made N. Y. Mgr. for Enterprise Engine

The Enterprise Engine Company, Inc., announces the appointment of G. C. Smith as Manager of its New York office at 44 Wall Street, New York City.

Mr. Smith, a graduate of the Webb School of Naval Architecture and Marine Engineering, has had wide experience in the marine and stationary diesel engine fields and also in the design of power generation and industrial applications.

Herbert Anderson, who has been with the Enterprise organization for a number of years, will continue in his position as Assistant District Manager of the New York Office.

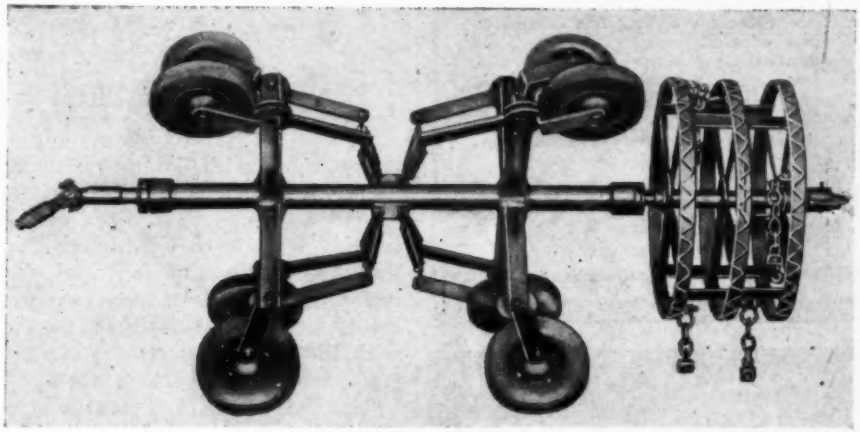
New Appointments at Hooker

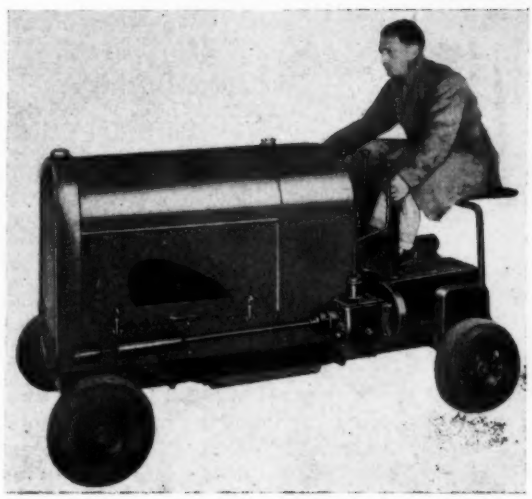
H. W. Hooker, Jr., Purchasing Agent

The Hooker Electrochemical Company, Niagara Falls, New York, has announced the appointment of Horace W. Hooker, Jr. as Purchasing Agent for the company. Mr. Hooker, a graduate of Cornell University, has been associated with the company since 1934. For the past six years he has been Assistant Purchasing Agent. Prior to that he had been engaged successively in the Research and Development Department.

James S. Walker, a graduate chemist of Union College, joined the Hooker staff in 1940 and after experience both in research and in plant operations has been appointed Technical Service Representative with headquarters in Niagara Falls, N. Y.

"FLEXIBLE" HAS THE TOOLS





AND THE EXPERIENCE

"FLEXIBLE *HAS* THE TOOLS"—This was the comment of hundreds of delegates at the National Water Works Convention in San Francisco. This also has been the steady comment of hundreds of satisfied Flexible customers. The right tools plus the proper background of experience add up to fast, low cost pipe cleaning operations. And clean pipes mean savings in many ways—higher operating efficiency—less maintenance expense—added protection to capital investments.

Flexible has the tools—and the experience—and the combined output of two large, modern manufacturing plants—as well as a unique inventive ability which has solved many a tough line cleaning problem.

Check Flexible on your pipe cleaning needs. Do it today. It's well worth it. Address Dept. WS-8.

FLEXIBLE UNDERGROUND PIPE CLEANING CO.

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855 Board of Trade Bldg. Chicago 4, Ill.
401 Broadway New York 13
147 Hillside Terrace Irvington, N. J.
P. O. Box 165 Atlanta
41 Greenway St. Hamden, Conn.
1624 Harmon Place Minneapolis 3, Minn.
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P. O. Box 694 Pittsburgh
P. O. Box 447 Lancaster, Texas

WRITE FOR THIS BULLETIN

FOR

pH Control and WATER TESTS

A study of our 28-page Bulletin No. 602, containing the complete line of Hellige apparatus for pH control and water analysis, will enable you to form an intelligent opinion as to what is best suited for extending your present equipment or for an initial installation.

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3718 NORTHERN BLVD. LONG ISLAND CITY 1, N.Y.
HEADQUARTERS FOR COLORIMETRIC APPARATUS

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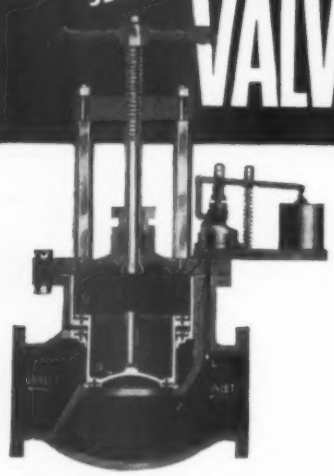
ELECTRIC and MANUAL
WATER SERVICE VALVES



Suitable for any spray service requirement or for remote electrical control. Instant manual or automatic operation. For any high or low pressure water service valve need—get the facts from Golden-Anderson. Over 1500 standard types and sizes.

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GOLDEN-ANDERSON
VALVE Specialty Company
PITTSBURGH 22, PA.

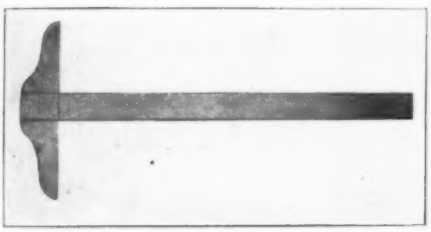
J. T. Woodson to Represent Eddy Valve

John T. Woodson, Manufacturers' Agent, Room 200, Independence Bldg., Charlotte, N. C., has been appointed to represent the Eddy Valve Co. in the states of North and South Carolina and Virginia south of the James River.

Pennsalt Opens Plant in Northwest

On June 21 the Pennsylvania Salt Company opened a new chlorine, caustic soda and DDT plant in Portland, Ore. The new, modern plant, built beside Pennsalt's chlorate plant, is the latest result of a 20-year project to expand Pennsalt's production with the increasing growth of industry in the Northwestern area. The initial production of chemicals at this plant is 200 tons per day.

Plastic T-Square



A new all plastic T-Square is now being marketed by the C-Thru Ruler Co. Features include edges of absolute accuracy and flat surfaces to allow a snug fit on top and sides of the drawing board. The plastic is completely transparent to permit an unhampered view of subject matter. The arm is not glued to the flat surface of the fixed head, but is fitted into a specially cut recess to insure even greater accuracy.

This plastic T-Square is available in 15, 18, 24, 30, 36, 42, and 47 inch sizes, as well as other sizes on special order, from the C-Thru Ruler Co., 827 Windsor St., Hartford, Conn.

P.F.T. ROTARY DISTRIBUTORS

For Maximum Utilization of the Filtering Area

P.F.T. Rotary Distributors provide a practical, efficient unit for dosing sewage to filter medium, in minimum area and with minimum piping. Operate at minimum head, frequently eliminating piping. Features include patented spreader jets that assure full, even coverage of the filter bed; triple valves and a positive mercury seal. Ask for Bulletin No. 213.

P.F.T. PACIFIC FLUSH TANK CO.
4241 RAVENSWOOD AVE., CHICAGO
NEW YORK • CHARLOTTE, N. C.
SAN FRANCISCO • LOS ANGELES

INSTALLATIONS WORLD WIDE
LARGEST CITY TO SMALLEST VILLAGE

VALVES COMPLETE EQUIPMENT FOR WATER WORKS FILTRATION AND SEWAGE DISPOSAL PLANTS
LATEST "COREY TYPE" HYDRANTS

Write for Catalogue and Information
IOWA VALVE CO.
General Offices:
Hubbell Bldg., Des Moines, Iowa
Plant:
Oskaloosa, Iowa

CHEMCO
Equipment
FOR
EVERY CHLORINATION
AND
WATER CONDITIONING
PROBLEM

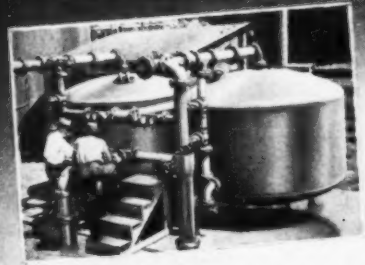
For Your
SEWAGE PLANT

CHEMCO CHLORINATORS are available for every type of installation. The above shows two CHEMCO 100# capacity chlorinator installed for the State of New York. Note use of Aqua-Thermal Coils.

For Your
SWIMMING
POOL

CHEMCO has "Everything for the Swimming Pool" from the Filters to the Life Preservers.

For Your
WATER WORKS

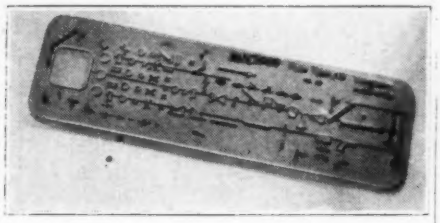


A large Chemco Filter Plant installation for the Santa Fe Railroad, Winslow, Arizona. Consult CHEMCO first for your Chlorinator or Water Conditioning Problem.

CHEMICAL EQUIPMENT CO.
1700 NO. MAIN STREET
P. O. Box 3098 Terminal Annex
Los Angeles 54, Calif.
MIDWEST FACTORY BRANCH
211 W. Wacker Drive Chicago 6, Ill.
AGENTS IN PRINCIPAL CITIES

Template for Design

Rapidsign, Inc., is now offering the No. 42 Flow Template for Gas, Oil, Water and Chemical pipe and



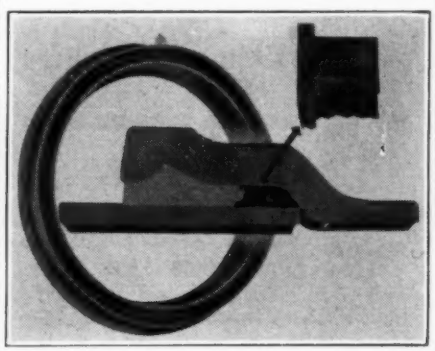
plumbing layouts. Cut outs cover all the symbols as shown in the American Standards Manual Z32.2.

The Flow Template is made of 0.040 mathematical-quality plastic. Printing is laminated between sheets to prevent wearing off. All symbol cut outs are beveled. Template size is 2¾x6¾ in. with rounded corners.

Direct inquiries to Charles Baron, Rapidsign, Inc., P. O. Box 592, Glendale, Calif.

New Joint Packing

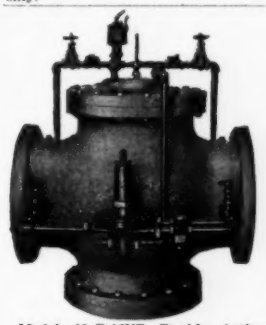
A new self-adjusting, self-locking rubber ring packing for the pouring of wet or dry bell and spigot cast iron pipe joints is announced by Smith-Blair, Inc., South San Francisco, California. The manufacturer calls it *Water-Lock Ring* and states that it can be used with any



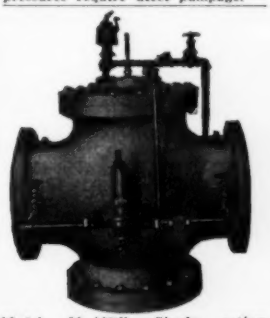
joint compound and can be installed quickly without cutting or fitting. He also says that it is the only sealing ring hydrostatically designed to increase its sealing action automatically from the pressure in the line. Without compound, it will hold 40 to 60 pounds of pressure. Because the ring is non-porous, it cannot be a culture point for bacteria or other contaminating elements. In addition to Water-Lock Ring, Smith-Blair manufactures bronze service clamps, steel and C.I. flexible couplings and flexible reducing couplings.

Est. 1879
ROSS
AUTOMATIC
VALVES

Altitude Valves for tank and reservoir, with two sets of controls—Automatic Hydraulic and Electric Remote Control. Hydraulic pilot normally operates the valve, while electric pilot is used for emergency only.



Model 40-DAWR Double Acting may be operated by electric pilot regardless of elevation of water in tank or reservoir, for a break in supply or distribution and when fire pressures require diect pumpage.



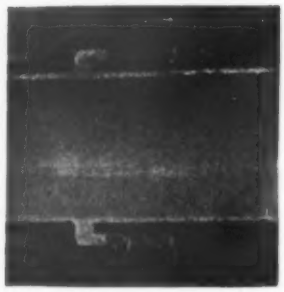
Model 30-AWR Single acting valve may be contolled in same manner as the Model 40-DAWR.

Model 40-AWR Single Acting semi-throttling valve will close on reversal of flow and the electric pilot would serve only a single purpose—either to open wide or close as emergency may require.

ROSS VALVE MFG. CO.
Incorporated
P.O. BOX 595, TROY, N.Y.

The TATE Cement Lining Process
Restores efficiency of old Water Mains

Now is the time to investigate the Tate Cement Lining process —and see what it can do to restore the efficiency of your old water mains.



View showing Tate Process in Pipe Joint. Note thoroughness of Lining.

Write for Literature.

What the TATE Process accomplishes

1. Water mains cleaned and cement-lined without removing pipe.
2. Eliminates discoloration and further cleaning costs.
3. Reduces pumping costs.
4. Restores reduction in head and flow co-efficients. This means full fire protection and lowered insurance rates.
5. All joints cement-lined . . . just one continuous pipe.
6. Does the job without interruption of service to consumer.

TATE PIPE LININGS, Inc.
ANDOVER, MASS.

FLANGED PIPE

FLEXIBLE JOINT PIPE

BELL & SPIGOT PIPE

SPECIAL CASTINGS

SHORT BODY BELL & SPIGOT SPECIALS

Large stock enables us to make prompt shipments.

84" pipe—Spring Lake, N. J.

CAST IRON PIPE

SIZES 3" TO 84"

Warren Foundry & Pipe Corp.

11 Broadway, New York

Warren Pipe Company of Mass., Inc.

Hardy New Pres. American Car and Foundry

Charles J. Hardy, Jr., heretofore Executive Vice Pres. of the American Car and Foundry Co., was elected to the presidency, succeeding F. A. Stevenson, who resigned after more than 40 years' service with ACF in various capacities.

Mr. Hardy served in the U. S. Naval Reserve World Wars I and II and is member of the Bar of the State of New York.

Electric Impact Tool

Ingersoll-Rand has announced a new electric impact tool, which may be used for many purposes. It will apply and remove nuts, drill, ream, tap, drive and remove screws, drive and remove studs, extract broken cap screws and studs, run wire brushes,

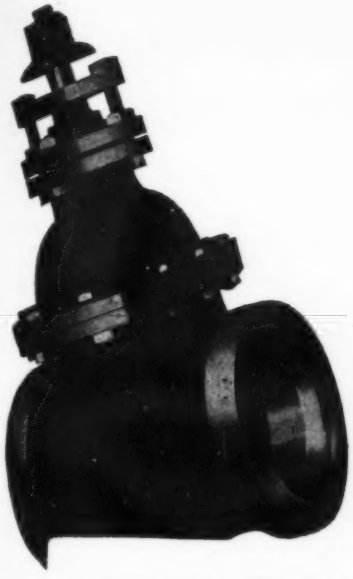
do hole saw work, drill brick and masonry and drive wood augers, using standard attachments.

In addition to the impact tool with 12 feet of 3-conductor cable, a series of hexagon sockets, collet-type chuck, taper sockets, and Allen Wrench accessory equipment is available for various uses. Write Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.

Protective Coating for Tanks and Pipes

A new improved application technique for field installation of heat-hardening (BAKELITE) films has been developed by Stalpic Coating Corporation, Chicago.

This process produces vitreous, smooth, corrosion-resistant barriers at the site on new or existing metal equipment, the interior or exterior of pipes and tank interiors. These barriers are inert enough for contact with pure food-stuffs and rugged enough to be used in handling acids, salt solutions, solvents and oils.



EDDY *Valves* and HYDRANTS

WILL THE MEN WHO FOLLOW YOU SAY YOU "KNEW YOUR STUFF"?

They will if you put in valves and hydrants now that will still be trouble-free in years to come. To be sure of this, specify EDDY —when you buy. EDDY products have been built by men with three generations of specialized experience. Eddy products have served three generations of water works men exceptionally well. Buy the product you know you can depend on.

EDDY FOR LONG SERVICE

EDDY VALVE COMPANY
WATERFORD NEW YORK

To help users determine the best coating for specific exposures, the company offers literature, laboratory tests, and consultation services. Steel rods, coated with a recommended film, are available when requests are accompanied by data describing contemplated uses. Further information may be obtained from the Stalpic Coating Corp., 1128 W. Armitage Ave., Chicago 14, Illinois.

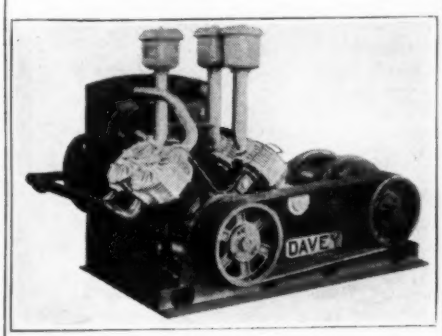
Dearborn Chemical Has New Chicago Sales Engr.

E. T. Erickson, for the past three years Chemical Engineer in the Industrial Water Treating Division of the Dearborn Chemical Co., has been placed in charge of the Chicago City Sales Department, according to a recent announcement.

New Davey Compressor Line

The Davey Compressor Co., has announced a complete new line of two-stage, air-cooled industrial air compressors of 60, 105, 160, 210, 315 cfm. capacities.

Known as "Air Chief Industrials," these machines feature Permanent



Peak Efficiency Valves and the new Davey Equi-Balanced crankshaft.

Air Chief Industrials are available in four types: (1) Base Compressors; (2) Stationary units with base ready for installation of customer's electrical equipment; (3) Departmental Compressors powered by A.C. motors; (4) Departmental Compressors with D.C. motors.

Further information may be obtained from the Davey Compressor Co., Kent, Ohio.

DON'T FIGHT DUST . . . ELIMINATE IT!

Install OMEGA CHEMICAL FEEDERS with Dust Removers

OMEGA Dust Removers overcome the dust nuisance permanently — a real contribution that will lighten the housekeeping task in your plant. The OMEGA Lose-In-Weight Gravimetric Feeder and Lime Slaker, shown with Dust Remover mounted on feeder hopper, is a combination famous for accuracy, dependability, and cleanliness. It weighs, feeds, and records within 1% by weight; available in sizes to feed ½ to 5,000 lbs. per hour. Write for Bulletins.

Specify Dust Removers with your order for OMEGA Feeders.

OMEGA PRODUCTS

Volumetric Feeders • Gravimetric Feeders • Solution Feeders • Lime Slaking Equipment • Bucket Elevators • Laboratory Stirrers.

OMEGA MACHINE CO.
(Division of Builders Iron Foundry)
10 CODDING ST., PROVIDENCE 1, R. I.

MECHANICAL EQUIPMENT BY ROBERTS FILTER MFG. CO. DARBY, PENNA.

KNOWN AROUND THE WORLD AS THE SIGN OF EXCELLENCE IN WATER TREATMENT EQUIPMENT

The years of experience behind the Roberts nameplate is your assurance that any water rectification problem is expertly handled to your best advantage. As manufacturing and installation engineers, the Roberts organization is equipped to meet your exact needs regardless of the size of the equipment or the complexity of the problem.

GRAVITY FILTERS • SOFTENING PLANTS AND EQUIPMENT • PRESSURE FILTERS ZEOLITE SOFTENERS • SWIMMING POOL RECIRCULATING APPARATUS SPECIAL WATER TREATMENT EQUIPMENT

We invite your inquiries

ROBERTS FILTER MANUFACTURING COMPANY • *Darby, Pa.*

AMERICAN GAS BOILERS
STEAM AND WATER TYPES
for Digester Heating

FOR RATINGS AND DATA SEE OUR PAGE IN THE 1947 ANNUAL REFERENCE SECTION

American Radiator & Standard Sanitary Corporation, Pittsburgh 30, Pa.

AMERICAN-Standard
HEATING PLUMBING
Serving the Nations' Health and Comfort

SALES OFFICES IN PRINCIPAL CITIES

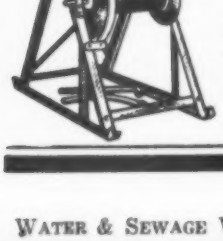
RUSTA RESTOR *Prevents Rusting*

Modern, Service-Proved Cathodic Method Gives Lasting Protection Against Rusting—Minimizes Tank Maintenance—Costs Only Two Mills ($0.002) Per Year Per Square Foot of Surface Protected.

Approved and endorsed by national and state authorities, Rusta Restor, the modern cathodic method, maintains the tank in a "neutralized" state that not only prevents rusting but also removes the products of any earlier rusting. It eliminates both the loss of service, and cost, of interior painting. Rusta Restor equipment is inexpensive to install, and cheap to operate. Used from coast-to-coast. Send for full details today.

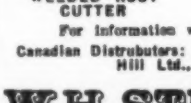
RUSTA RESTOR
A DIVISION OF
THE JOHNSTON AND JENNINGS COMPANY
853 ADDISON ROAD • • • CLEVELAND 14, OHIO

Your PIPE CLEANING PROBLEMS SOLVED

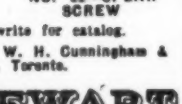


STEWART STANDARD WINDLASS

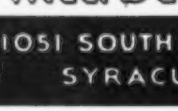
Frame. Sturdy angle iron construction. Cable drum holds 1100 ft. of ⅜" cable. Shipping weight without cable 250 lbs.



STEWART STEEL SECTIONAL ROD



STEWART GUARD CAGE COLLAPSIBLE BUCKET



NO. 9A STEWART WELDED ROOT CUTTER

NO. 11—SCREW
NO. 22—SPEAR SCREW

For information write for catalog.

Canadian Distributors: W. H. Cunningham & Hill Ltd., Toronto.

W.H. STEWART
1051 SOUTH CLINTON ST.
SYRACUSE, N.Y.

LITERATURE AND CATALOGS

Packing

In a four-page folder, the Greene, Tweed & Co. of New York, describe their **Palmetto Pyramid packing**, advertised as "the most talked about improvement in molded 'VEE' type packings." This bulletin shows the molded Vee type packing and describes its several features.

This bulletin on Palmetto Pyramid packings may be obtained from Greene, Tweed & Co., Bronx Blvd. at 238th Street, New York 66, N. Y.

Filter Underdrain Block

Infilco, Inc. has just released a new bulletin, describing and illustrating **Accelo Hi-Cap Filter Underdrain Blocks.** These blocks were developed especially for use in all types of high rate or high capacity biological filters.

The bulletin explains that these blocks are manufactured for Infilco by the well known Ayer-McCarel-Reagan Clay Co., of Brazil, Ind., as their ARMCRE Type AA. Photographs of the blocks are shown, together with the means of installation, and a diagram of a suggested method of laying out. The blocks call for low frictional resistance, long permanency and are economical. They provide adequate drainage and aeration needed for proper operation of high rate sewage filters.

Bulletin 6220, describing these Accelo Hi-Cap Filter Underdrain Blocks, may be obtained by writing to Infilco, Inc., 325 West 25th Place, Chicago 16, Ill.

Granular Germicide

The Columbia Chemical Div. of the Pittsburgh Plate Glass Co. is now marketing an improved granular germicide and disinfectant. This material, composed essentially of a stabilized calcium hypochlorite, has been named **Pittcide.** It is described in a booklet of that name issued by the company.

The booklet contains details of the proper Pittcide solution strength for 162 applications in 17 major fields. These fields cover all types of food factories, as well as homes, hospitals, schools, restau-

rants, swimming pools, and water supplies. Individual application details explain surface cleaning, method of applying, proper materials for applying, and similar information.

Copies of this booklet may be obtained by writing Dept. P, Pittsburgh Plate Glass Co., Columbia Chemical Div., Fifth and Bellefield Aves., Pittsburgh 13, Pa.

Septic Tank Cleaners

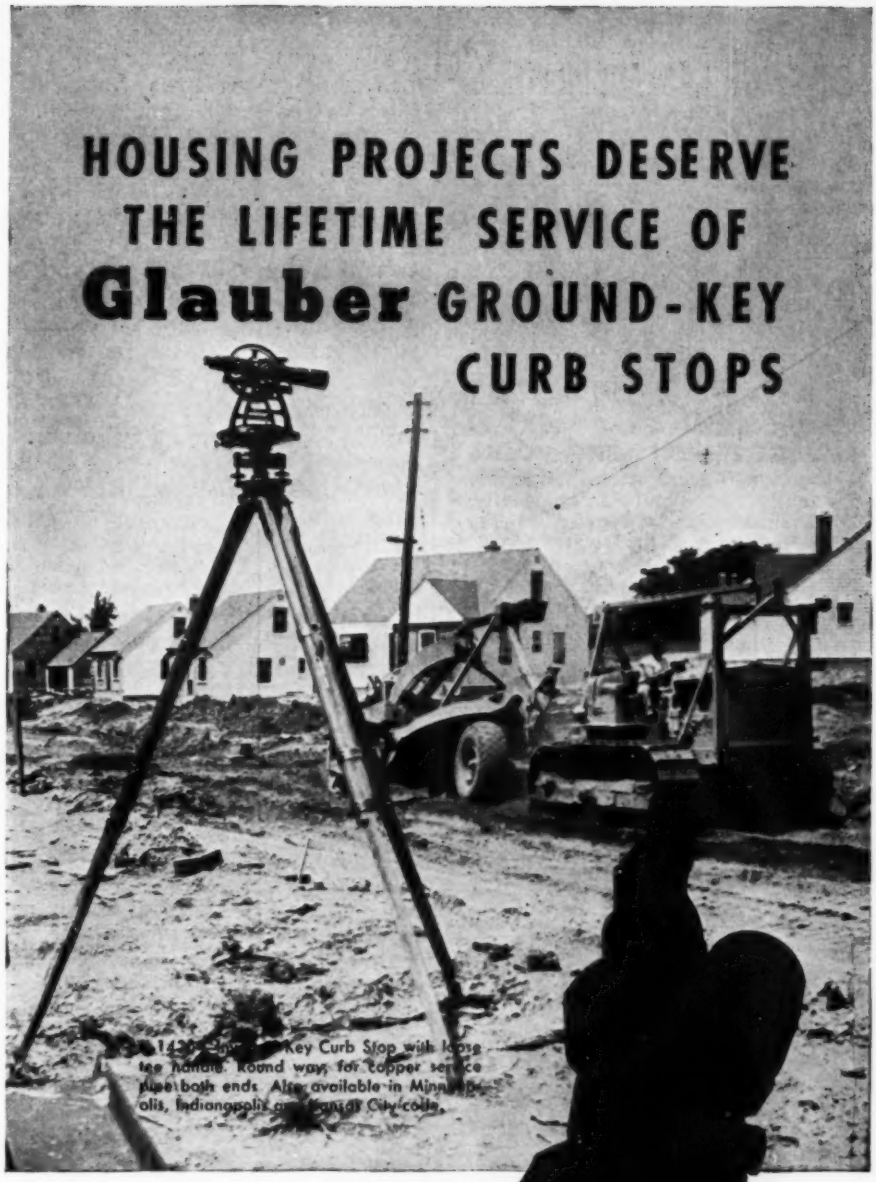
In an 8-page bulletin the Gorman-Rupp Company of Mansfield, Ohio, presents their **O.S.C., or Odorless Sanitary Cleaner,** and their new septic tank pumps. The septic tank cleaner consists of a new model pump mounted on the rear of a truck tank. This pump can take suction from a septic tank and discharge back into the tank with a jetting action to stir up the settled solids and then pump out the entire tank. The O.S.C. has numerous applications including the cleaning of cisterns, dewatering of flooded basements, wet wells, flushing streets, serving concrete mixers and as an auxiliary fire fighter.

Write for Form 7 ST-11 for the bulletin on the Gorman-Rupp Odorless Sanitary Cleaner, and address your request to Gorman-Rupp Co., Mansfield, Ohio.

Multiple Hearth Furnace

In a bulletin titled **Martin Multi-Zone Furnace,** the Morse Boulger Destructor Company presents "The Modern Multiple Hearth Furnace." This furnace is designed particularly for the incineration of sewage solids, and the bulletin shows a sectional elevation of a typical furnace arrangement, describes the odor control involved, zone control, operation, temperatures, rabbling equipment, continuous stoking, furnace drive, ash discharge, castings, stacks, etc. One section of the bulletin is devoted to the use of the multiple hearth as a dryer for fertilizer, and photographs show furnace room auxiliaries and typical installations. There is also a performance characteristics chart for sludge incineration, showing the oil consumption in gallons per dry ton as plotted against the volatile content of the dry solids and the moisture content in sludge cake.

Write for Bull. No. 114 on the Martin Multi-Zone Furnace; address your request to Morse Boulger Destructor Company, New York 17, N. Y.

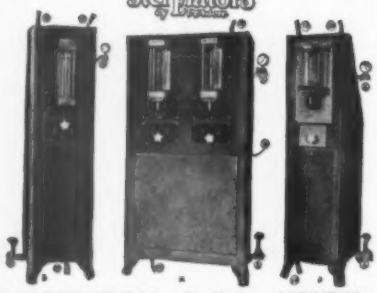


When water mains are laid and curb stops are installed, the job should be done right to provide trouble-free service for years to come. To make sure of this service and eliminate costly repairs, water works engineers and superintendents know from experience that Glauber red-brass curb stops operate just like new many years after their installation. Write today for quotations and the catalog of our complete red-brass line which is available to meet your water works installation specifications.

THE Glauber BRASS MFG. CO., KINSMAN, OHIO
Division of H. B. SALTER MFG. CO., Marysville, Ohio

FEED-METERS-MIXES
CHLORINE GAS ACCURATELY

SterElators by Everson



PURIFICATION FOR WATER-SEWAGE & SWIMMING POOLS

Everson SterElators Operate Manually or Semi-Automatically, Also Automatically Proportion Gas Flow to Water Flow.

Everson SterElators Utilize a 24" Water Gauge Vacuum and Visible Flow Meters, with Wide Ratio Ranges of Capacities: 10 to 1, 50 to 1, 110 to 1.

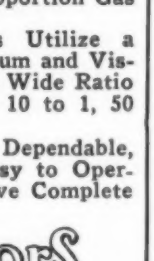
All SterElators Are Dependable, Accurate, Safe and Easy to Operate. Guaranteed to Give Complete Satisfaction.

SterElators by Everson

EVERSON MFG. CO.
233 W. Huron Street
Chicago 10, Ill., U. S. A.

WRITE FOR INFORMATION

VOGT BROTHERS TRAFFIC MODEL FIRE HYDRANT



A.W.W.A.

VOGT BROTHERS MFG. CO. Incorporated LOUISVILLE, KY.
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AERO-MIX

AERATOR—MIXER

A Size and Type to Fit Your Problem In Water or Sewage Treatment.

WRITE FOR INFORMATION

Plug Valves

The latest revised bulletin on **a.c.f. Full Pipe Area Lubricated Plug Valves** is an eight page pamphlet just released by the American Car and Foundry Co., New York. The bulletin contains a list of advantages of plug valves, facts about operation and servicing these valves, pictures of various types of plug valves, information on lubricants, and instructions for ordering a.c.f. valves, wrenches and lubricants.

Write to American Car and Foundry Co., Valve Dept., 30 Church St., New York, N. Y. for a copy of this latest information on lubricated plug valves.

Valve Control

The **Shafer Valve Control** is the title of a four page bulletin, issued by the Shafer Valve Co., in which both electrical and manual valve control mechanisms are shown. A list of valve controls for various applications is given—remote control—electric and remote control by pressure may be obtained. The Shafer valve control can be modified to operate either electrically or by fluid pressure; instrument control actuated by pressure, temperature, or time variations can be installed. Automatic safety shut-off and simplified design are featured. These valves can be used to control water hammer.

This bulletin on the Shafer Valve Control may be obtained by writing to the Shafer Valve Co., Inc., Mansfield, Ohio.

pH Control Handbook

Since the publication in 1944 of the 13th Edition of **The A B C of pH Control** by the LaMotte Chemical Products Co. there have, no doubt, been a number of new readers of these pages. We therefore again review this booklet which is a handbook on the subject of colorimetric pH determination, as well as a general catalog describing LaMotte equipment and chemical reagents.

The topic of pH Control is introduced by a brief discussion in simple language by the LaMotte Research Department, discussing such subjects as the value of pH control, the meaning of the pH scale, determining pH values by indicators, buffer action, indicators for special work, temperature effects, etc. The bulletin contains a handy guide for selecting pH equipment for various uses and, as stated, a catalog of La-

LEADITE
The Pioneer Self-Caulking Material for C.I. Pipe

4 REASONS
why more miles of cast iron water mains are jointed with LEADITE than with any other melted self-caulking material:

- MELTS EASILY
- GOES FARTHER
- SAVES TIME, LABOR COST OF MATERIAL

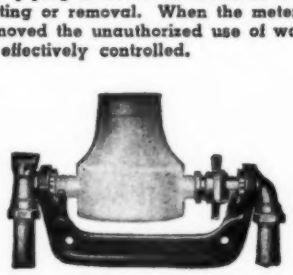
•MAKES A GOOD TIGHT . JOINT THAT IMPROVES WITH AGE!

THE LEADITE COMPANY
Girard Trust Co. Bldg., Philadelphia 2, Pa.

No Caulking

SATISFACTION

Ford Yokes satisfy all conditions necessary for dependable water meter settings. The meter can be installed and removed easily. The reliable inverted key angle valve can be seen easily and is operated with a light wrench. The piping is never disturbed in meter setting or removal. When the meter is removed the unauthorized use of water is effectively controlled.



Ford Yokes have been the standard meter setting in many water systems for over three decades because they have given complete satisfaction. Write for catalog and learn about the advantages you will obtain from setting your meters this better way.

The FORD
METER BOX COMPANY, INC.
Wabash, Indiana

Motte indicators and equipment, including the La Motte block comparator, universal pH outfit and various accessories for pH studies, etc. This bulletin also contains information on the LaMotte chlorine control units, including the chlorine colorimeter, chlorine block comparator as well as LaMotte outfits for control of swimming pool water, and other permanent standards for the analysis of water, sewage and industrial wastes.

The ABC of pH Control may be obtained from the LaMotte Chemical Products Co., Towson 4, Md.

Automatic Controls

General Catalog No. C-4, of the Automatic Control Co., St. Paul, Minnesota, presents control equipment for water works, sewage disposal and industry. This general catalog includes several individual bulletins, including those on Tanktrols (elevated tank control), hydropneumatic systems (pressure tanks), and float operated controls. The latter includes float switches, floatrols, selectrols, relay selectrols and remote selectrols. The general bulletin also includes a section on accessories.

This general catalog shows not only the various pieces of equipment for different uses, but shows how each one works and the proper place for installation of the various items.

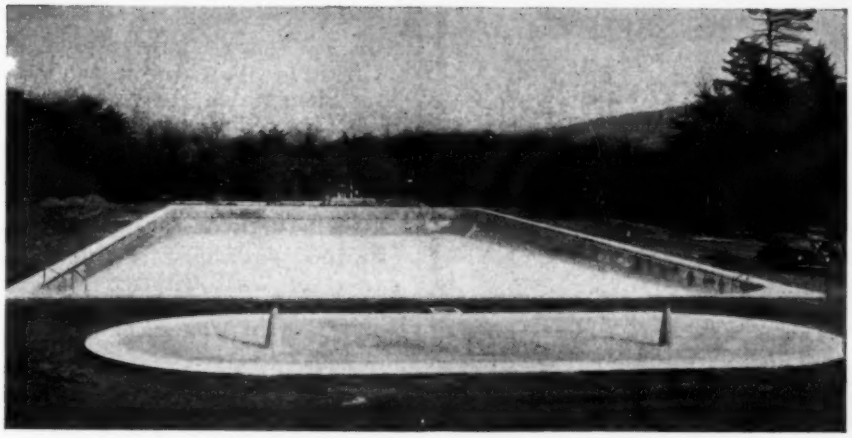
In the modern automatic operation of pumping stations and distribution systems these controls as shown in this catalog find wide use and application in the water and sewage works field.

General Catalog No. C-4 may be obtained by writing directly to the Automatic Control Company, 1005 University Avenue, St. Paul 4, Minn.

Flowrator

A new bulletin describing **Flowrator** instruments for measuring flow rate of liquids and gases has been published by the Fischer & Porter Company, of Hatboro, Pa. This catalog section 25-E contains descriptions and illustrations of instruments both assembled and disassembled. Also numerous accessories are shown, including a horizontal-line adaptor which makes it possible to insert these Flowrator meters in horizontal runs as well as in vertical runs.

This catalog section 25-E may be obtained by writing Department 9F-C, Fischer & Porter Company, Hatboro, Pa.



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Slaughter House Waste Treatment

In a 20-page mimeographed bulletin titled **Slaughter House Waste Treatment Guide,** the West Virginia Water Commission has presented important information on the treatment of slaughter and packing house wastes.

The bulletin covers a definition of terms, work done in other states, survey of West Virginia slaughter houses, treatment considered necessary, and an analysis of slaughter house wastes.

In addition there are appendixes on design considerations for plants larger and smaller than 40 hog-units, and sketches of settling tanks, standard rate filters and high rate filters.

Persons interested in the slaughter house waste treatment problem may wish to request a copy of the new bulletin from the West Virginia Water Commission, 1806 Washington St., E., Charleston, W. Va.

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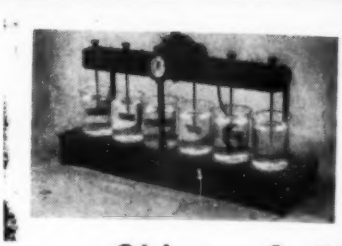

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The Carver-Stimpson Pipe Cleaning Company of Walters, Okla., has a small four page folder devoted to the **FLEX-O Hydraulic Pipeline Scrapers.** These scrapers are designed for hydraulic use in water mains, sewage force mains and waste water disposal mains. The folder shows a device which will make 90° bends and may be obtained in 4, 6, 8, 10, 12 and 14 inch sizes. The bulletin also shows the FLEX-O scraper parts, and the list price of each.

This bulletin, or other information on the pipeline scraper may be obtained from the Carver-Stimpson Pipe Cleaning Co., Walters, Okla.

Small Scale Biofiltration

In Leaflet No. 7312, The Dorr Co. presents **Small Scale Biofiltration** with the Dorr Duo-Clarifier and the Dorrco Duo-Filter.

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According to the leaflet, this combination may be applied for treating domestic sewage in small communities, milk wastes, or wastes from industrial plants. A variation of the Duo-Clarifier may be combined with the Clarigester to provide digestion in the same structure. Operating data from two waste treatment plants show 95 per cent B.O.D. removal, 90 per cent suspended matter removal, and 40 to 60 per cent total solids removal.

Leaflet No. 7312, or further information on Small Scale Biofiltration may be obtained by writing directly to the Dorr Company, 570 Lexington Ave., New York 22, N. Y.

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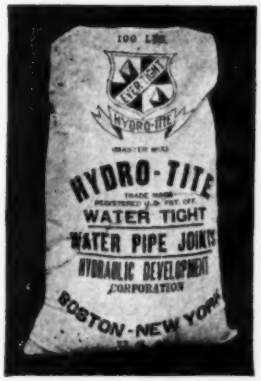

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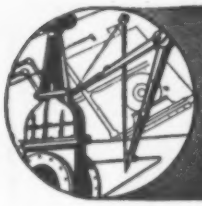

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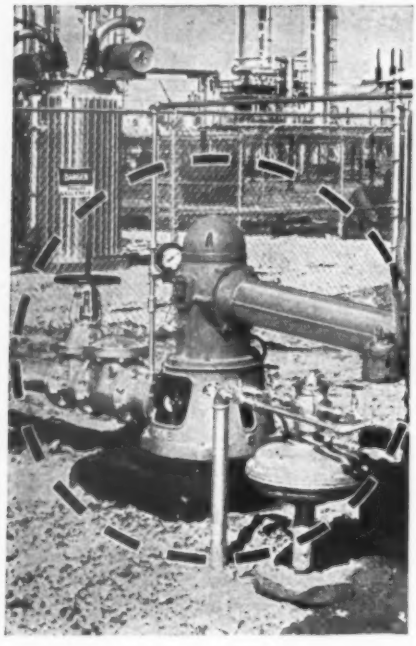

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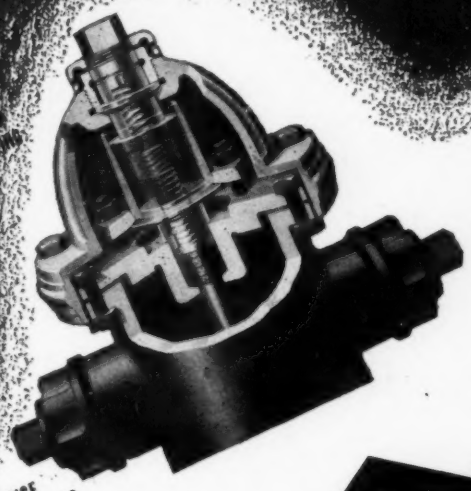

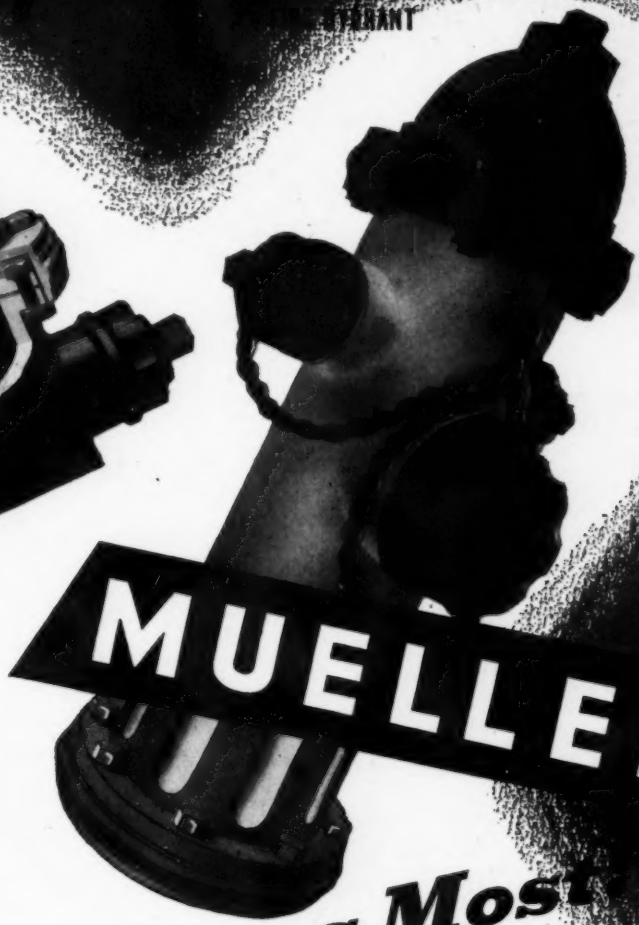

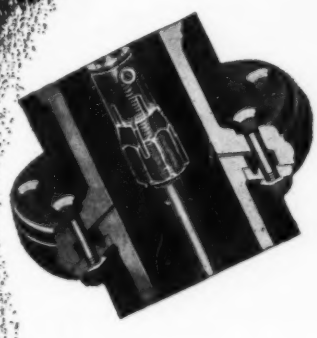

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